PRELIMINARY ASSESSMENT

of

METAL COATINGS CORPORATION

(TXD072181969)

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Reviewed by Bud Marks 10-8-92

Prepared By

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Region 6

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METAL COATINGS CORPORATION (TXD072181969)

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1.0 INTRODUCTION

The Region 6 ARCS contractor, MK Environmental Services and ICF Technology, Inc. (MK/ICF) was tasked by the U.S. Environmental Protection Agency (EPA) under ARCS Contract No. 68-W9-0025 and Work Assignment No. 29-6JZZ to complete the Preliminary Assessment (PA) started under the Field Investigation Team (FIT) contract, of Metal Coatings Corporation (TXD072181969) in Houston, Harris County, Texas.

The purpose of a PA is to determine whether further investigations are warranted and provide a preliminary screening of sites to facilitate EPA's assignment of site priorities.

The PA investigation focuses on determining CERCLA eligibility, reviewing available file information, documenting the presence and type, or absence of uncontained or uncontrolled hazardous substances on-site and in the collection of area receptor and site characteristic information.

2.0 SITE DESCRIPTION AND OPERATIONAL HISTORY

This section addresses operational history, waste containment, hazardous substance identification, and regulatory status of the facility.

2.1 SITE LOCATION

The Metal Coatings Corporation (MCC) is an active electroplating and metal finishing facility located on the western side of the Houston metroplex at 3720 Dunvale Avenue. The site is identified as occupying approximately 3 acres (Ref. 13, pp. 1-2). The geographical coordinates are 29°43'49.0" north latitude and 95°30'50.0" west longitude (Figure 1). The facility is owned and operated by Mr. Mike Rountree (Ref. 13, p. 1).

2.2 OPERATIONAL HISTORY

The electroplating processes involve consecutive washes and emulsions in water, sulfuric acid, hydrochloric acid, cyanide baths and phosphate salt solutions. Rinse waters from the tanks are removed approximately once a week by a diaphragm pump into holding tanks and eventually introduced into the 2,000 gallon evaporator tank (Ref. 13, p. 3)(Figure 2). Cadmium electroplating no longer occurs at the site and was discontinued in 1988. Some zinc and phosphate salt plating is still done on-site (Ref. 13, p. 2).

Mr. Rountree explained the current plant process from a previously developed process diagram dated July 26, 1988, indicating that the feed sumps are now dry, the chromium reduction and the treatment holding tanks are no longer in use but are now stored at the facility. MCC does not discharge any wastewaters into the city sewer systems (Ref. 9, p. 2; Ref. 13, p. 2)(Figure 3).

Mr. Rountree continued explaining that current operations at MCC involve the preparation of nuts and bolts for Teflon coating. This coating goes by the registered trade name Fluorocoat. The application is sprayed on and then baked. Current spraying operations involve the use of four overspray booths. These booths incorporate metal baffles to collect the overspray. These

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CAD FILE	
APPROVED BY	
REVIEWED BY	KT
DRAWN BY	KP
PREPARED BY	KT

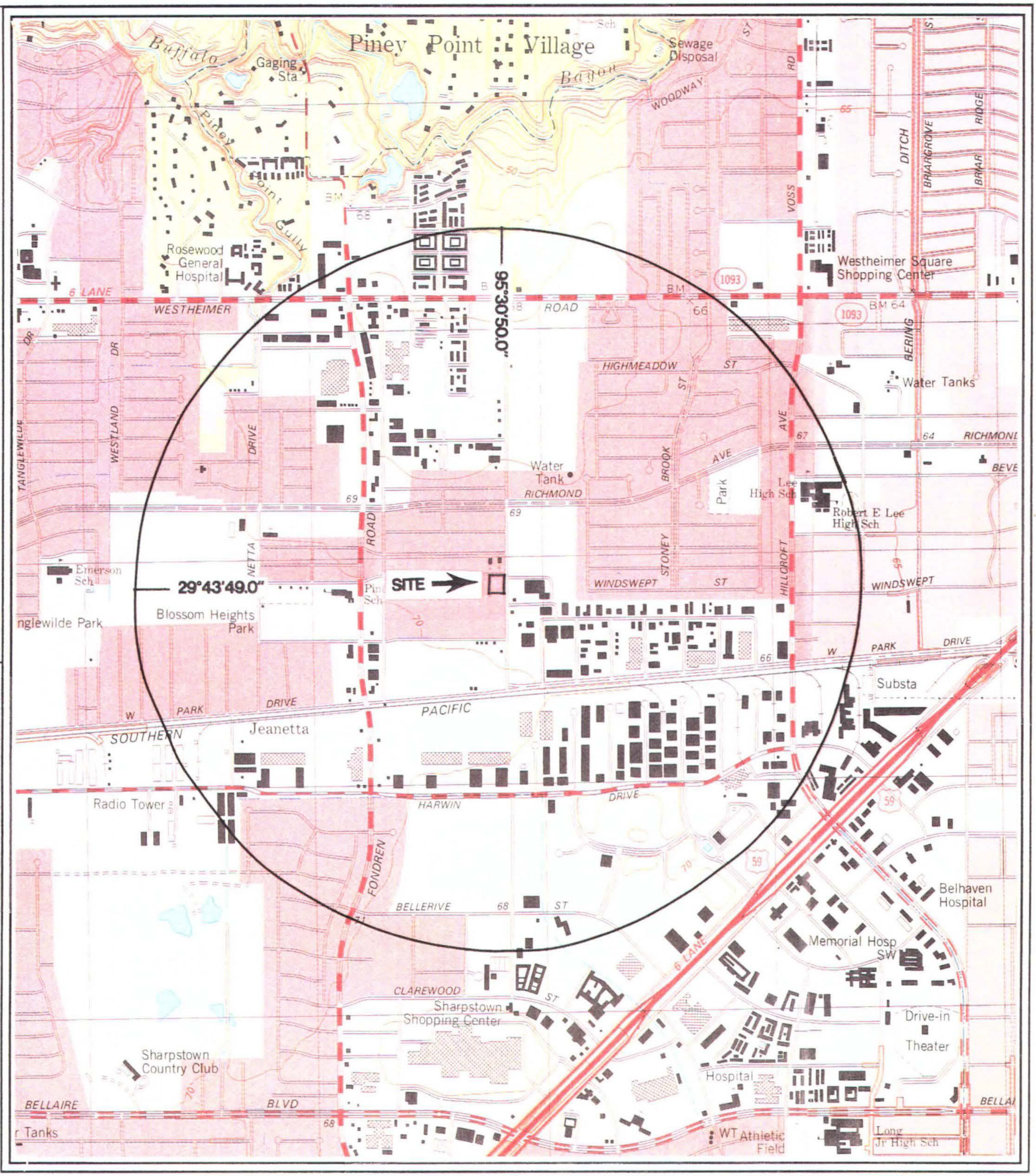

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FIGURE 1

SITE LOCATION MAP

METAL COATINGS CORPORATION
HOUSTON, TEXAS

CERCLIS #TXD072181969

QUADRANGLE LOCATION

ALIEF, TX. 1982

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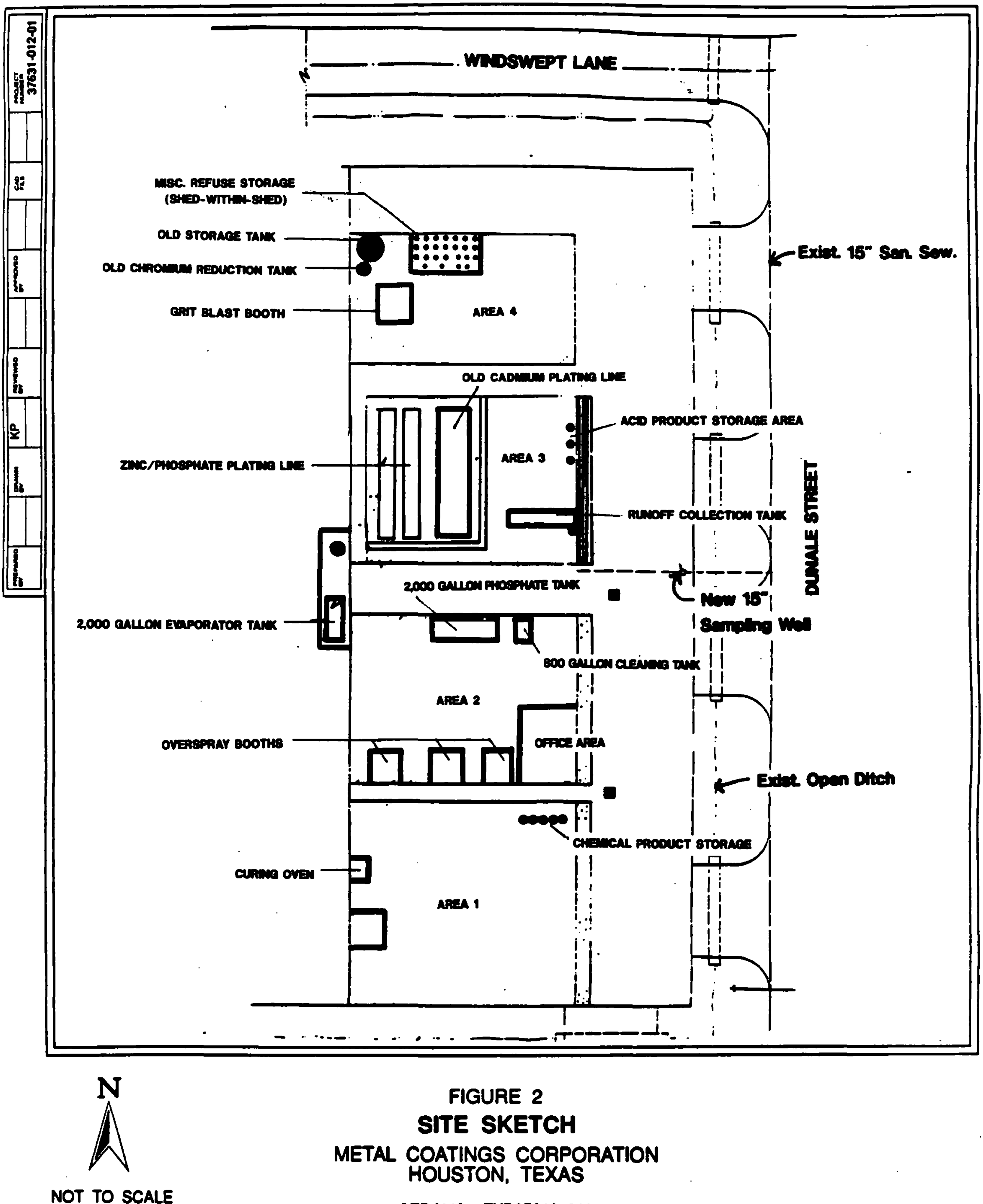

FIGURE 2
SITE SKETCH
METAL COATINGS CORPORATION
HOUSTON, TEXAS

CERCLIS #TXD072181969

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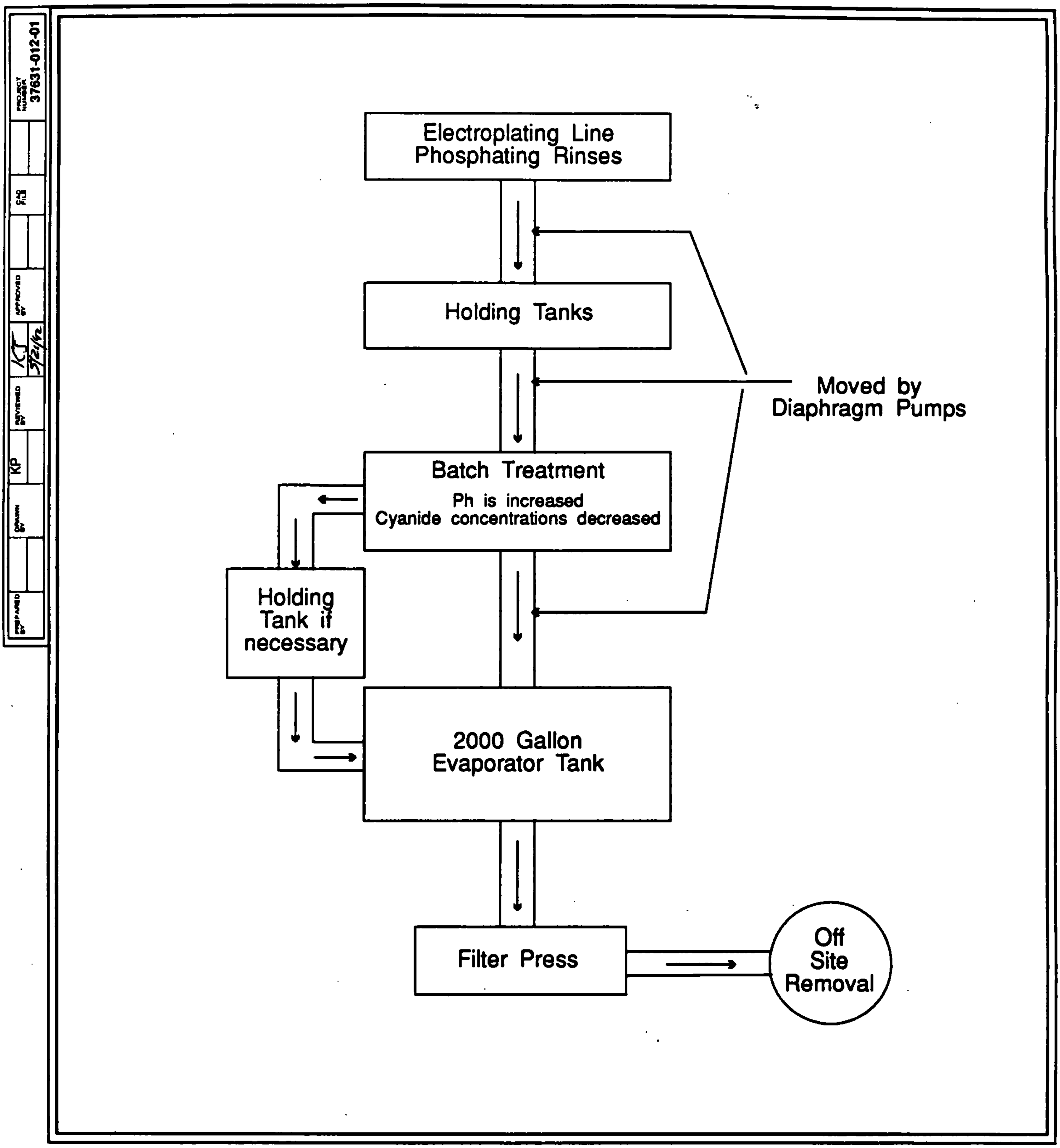

FIGURE 3

PROCESSING DIAGRAM

METAL COATINGS CORPORATION
HOUSTON, TEXAS

CERCLIS #TXD072181969

baffles are periodically baked in the process ovens and the dried paint is collected as an industrial waste that can be disposed in a Type II landfill (Ref. 13, p. 2).

MCC submitted EPA Form 3510-1 and 3510-3 on November 7, 1980 indicating the facility was a generator of listed hazardous waste code F007, which resulted from the application of protective coatings to formed metal parts consisting of spray and hand applied paint products and electroplating of cadmium and zinc (Ref. 1, pp. 2, 5). MCC operates under the Standard Industrial Classification Code 3471 (Ref. 1, p. 2).

The Texas Department of Water Resources (TDWR) received an anonymous complaint on February 5, 1985 concerning MCC, alleging the company washes off equipment directly onto the ground and that the washwater drains into storm sewers located on Dunvale Avenue. The complainant also noted strong solvent odors in the area (Ref. 2). The TDWR investigated the complaint the following day discovering an air compressor leaking oil and draining into the sanitary sewer system. The drainage from the air compressor was permitted by the City of Houston. There was no evidence of washwater draining into the sanitary sewer system (Ref. 2, pp. 1-2).

On April 14, 1986, MCC submitted to the Texas Water Commission (TWC) a consent to revoke TWC permit No. HW-50017-000 indicating activities regulated by this permit had been terminated in December 1984 (Ref. 5). The TWC responded to MCC's request of revocation on September 19, 1986, indicating that MCC should continue with the previously approved closure plans of the hazardous waste tank. MCC was to verify decontamination of the tank by analyzing a sample of the tank rinse water for total cyanides and compare the results to that of a similar analysis of the water used for decontamination, prior to rinsing. The results of these analyses were then to be submitted to the TWC and that a second Consent for Revocation letter be submitted (Ref. 6, p. 1).

MCC submitted a letter of certification from a registered professional engineer, indicating the hazardous waste storage facility (tank) had been closed according to provisions set forth in the plan. Analytical results from the tank decontamination rinse and hazardous waste manifests documenting the removal of the wastes from the site, on December 17, 1986 were also included. The manifest from the removal indicates that 1 drum of waste was removed by Alstate Vacum & Tanks, Inc. for disposal at Empak, Inc. in Deer Park, Texas (Ref. 7, pp. 1-4). Official revocation of TWC Permit No. HW-50017-000 was issued by the TWC on January 6, 1987 (Ref. 8).

MCC notified the TWC on September 28, 1988 to amend the facility's registration to indicate that MCC is generating spent solvent wastes that include methyl-ethyl ketone (MEK), isopropyl alcohol (IPA), dimethylformamide, toluene, mineral spirits, acetone and methylene chloride. The solvents were used in the clean up of paint spray equipment. Approximately ten gallons per month were generated. Additionally, MCC informed the TWC of their generation of evaporator sludge from zinc and cadmium plating wastewater. The wastestream was to come from caustic cleaner rinses, sulfuric and hydrochloric acid rinses, plating rinses, chromating rinses and phosphating rinses. After collection of the sludge from the evaporator, it was dried in one of MCC's process ovens and then drummed (Ref. 9, p. 1).

MCC reported to the TWC on October 4, 1988, that the facility was presently working on the removal of soil at the facility which had been contaminated with spent acid and caustic cleaner sludges. The acids and caustic cleaners were used to pickle and remove oil from bolts and nuts prior to plating. The contamination originated from cadmium plating processes, and a ruptured tank in 1984, before containment structures had been implemented. The City of Houston conducted soil testing on July 15, 1988 in the contaminated area and found that concentrations of cadmium were considered to be above EP Toxicity standards. MCC also requested that these wastes be classified as Class II wastes for disposal purposes (Ref. 10, pp. 1-4).

The TWC responded to MCC's request on November 23, 1988 stating that the EP toxicity results submitted showed a leachable cadmium concentration of 13.7 parts per million (ppm), 9.9 ppm and 6.65 ppm. These wastes were considered to yield leachates having cadmium concentrations above allowable levels and were classified as hazardous waste (classification D006) as directed in 40 CFR Section 261.24 (Ref. 11, p. 1; Ref. 12, pp. 46, 47).

2.3 WASTE CONTAINMENT AND HAZARDOUS SUBSTANCE IDENTIFICATION

MCC is a generator of listed hazardous waste codes F006 and D006, from electroplating operations. Manifests supplied by MCC indicate that over 94 cubic yards of wastes coded F006 and D006 have been disposed by Chemical Waste Management, Inc. and Horsehead Resource Development Company, Inc. since January 13, 1992 (Ref. 15, pp. 4-7).

The MK/ICF ARCS personnel identified several product and waste management units during the February 4, 1992 site visit, noting location and integrity of individual units (Figure 2). MK/ICF personnel toured an open area in back of the facility housing a 2,000 gallon evaporator tank. The area around the tank has no engineered containment structures (Ref. 13, p. 3)(Appendix A, Photograph 3).

The electroplating area (Area 3) is surrounded by a six inch concrete berm structure. Additionally, the cyanide bath tank is bermed in the same manner. The integrity of the berm was poor with evidence of breached integrity and attempts to patch the cracked concrete portions (Ref. 13, p. 3)(Appendix A, Photographs 4 and 7).

MCC also operates a 2,000-gallon phosphating solution tank and an 800-gallon caustic soap cleaning tank. Neither of these tanks have engineered containment structures (Appendix A, Photograph 2)(Ref. 13, p. 3).

Area 4 identified on Figure 2, houses a shed within a shed that is used to store miscellaneous trash and the remaining barrels from soil removal. The materials that remain in this area for future disposal are drums that have not been triple-rinsed, additional soil from regular clean-up of the area and dry paint flakes (Ref. 13, p. 3)(Appendix A, Photograph 8).

MCC reported to the EPA November 17, 1980 that it operated two above-grade, hazardous waste storage tanks located outside and behind the facility (Ref. 1, p. 7). The tanks reportedly had a maximum combined capacity of 5,260 gallons (Ref. 1, p. 3). Mr. Rountree stated that one of the tanks had since been cut-up and sold as scrap. The remaining tank has been brought inside of the facility and serves as a runoff collection tank for the electroplating area (Ref. 13, p. 2)(Appendix A, Photograph 6)(Figure 2).

MCC operates additional areas which are used as drummed product storage areas of MEK, acetone and IPA (Ref. 13, p. 3)(Figure 2).

The contaminated soil that was reported at MCC in 1988 was excavated and stored in drums. The amount stored at the facility was approximately 4 to 6 cubic yards. Mr. Rountree contracted Chemical Waste Management, Inc., Carlyss, Louisiana to begin the removal in November 1990. Chemical Waste Management, Inc. ran profiles on the wastes to be accepted and collected three of the five roll out containers of F006 sludges that had been mixed with the 4 to 6 cubic yards of contaminated soil. The remaining two roll out containers of waste were considered to have concentrations of cyanide too high to accept. Mr. Rountree contracted Horsehead Resource Development Company, Inc. (TND982144099), Rockwood, Tennessee, to remove the remaining amount of accumulated F006 sludge wastes and the remaining cadmium and cyanide contaminated soils (Ref. 13, p. 1).

2.4 REGULATORY STATUS/ACTIVITIES

MCC was issued Texas Water Commission (TWC) permit No. HW-50017-000 on February 26, 1985 (Ref. 3, p. 1). This permit allowed MCC to store industrial solid waste generated from plant sources including waste pickling/plating solutions and waste rinsing/phosphating solutions. The wastes were to be stored in an above-grade, open-top, steel storage tank with a maximum waste capacity of 1,875 gallons (Ref. 3, p. 2). The hazardous waste storage tank was located outside, at the back of the facility (Ref. 1, p. 7).

MCC requested to the TWC on December 4, 1985 that changes to the facility's permit registration be made, including the addition of the generation of hazardous waste F008 and F006, spent filter cartridges (Ref. 4).

MCC reported to the TWC on October 4, 1988, that the facility was presently working on the removal of soil at the facility which had been contaminated with spent acid and caustic cleaner sludges. The acids and caustic cleaners were used to pickle and remove oil from bolts and nuts prior to plating. The cause of the contamination was evidently due to cadmium plating processes. The City of Houston conducted soil testing on July 15, 1988 in the contaminated area and found that concentrations of cadmium were considered to be above EP Toxicity standards (Ref. 10, pp. 1-4). MCC also requested that these wastes be classified as Class II wastes for disposal purposes (Ref. 10, p. 1).

The TWC responded to MCC's request on November 23, 1988 stating that the EP toxicity results submitted showed a leachable cadmium concentration of 13.7 parts per million (ppm), 9.9 ppm and 6.65 ppm. These wastes were considered to be above allowed leachable concentration levels and were classified as hazardous waste classification D006 as directed in 40 CFR Section 261.24 (Ref. 11, p. 1; Ref. 12, pp. 46, 47).

2.5 SUMMARY OF RECONNAISSANCE INSPECTION

The MK/ICF ARCS personnel conducted the on-site reconnaissance inspection of MCC on February 4, 1992. The MK/ICF ARCS team met with the plant owner Mike Rountree who supplied requested information and conducted the tour of the facility (Figure 2)(Ref. 13, P. 1).

Mr. Rountree stated that MCC is operating under (TWC Generator Permit No. 31596) generator status and that they no longer generate waste filter cartridges as indicated on the TWC Notice of Registration Solid Waste Management (Ref. 13, pp. 1-2; Ref. 14, pp. 2-3).

Hazardous waste sludges from the evaporator tank are currently filter pressed by Escandell Associates, Inc. Escandell Associates, Inc. supplies a portable filter press service, mounted on a tractor trailer, as needed. The filter cake sludges are disposed by Horsehead Resource Development Company, Inc. (TND982144099), Rockwood, Tennessee (Ref. 13, pp. 1-2, Ref. 15, pp. 4-7).

3.0 PATHWAY ASSESSMENT

This section characterizes the environmental pathways and associated targets of contaminant migration from the facility.

3.1 GROUND WATER PATHWAY

3.1.1 Ground Water Characteristics

The hydrogeologic units underlying the site are the Chicot Aquifer, Evangeline Aquifer, and the Burkeville confining layer. These units are composed of sedimentary deposits of gravel, sand, silt and clay. The geologic formations, from oldest to youngest, are: the Fleming Formation and Oakville Sandstone of Miocene age; the Goliad Sand of Pliocene age; the Willis Sand, Bentley Formation, Montgomery Formation, and Beaumont Clay of Pleistocene age; and alluvium of Quaternary age (Ref. 16, p. 3).

The Chicot Aquifer includes all deposits from the land surface to the top of the Evangeline Aquifer. The Chicot Aquifer is composed of the Willis Sand, Bentley Formation, Montgomery Formation, Beaumont Formation, and Quaternary alluvium (Ref. 17, p. 3). The altitude of the base of the Chicot Aquifer in the area of the site is approximately 600 feet below sea level (Ref. 18, Section C-C' Figure 4). The discontinuous sand and clay layers of the Chicot Aquifer in some parts of the area are separated into an upper and lower unit. When the upper unit of the Chicot Aquifer cannot be defined, the aquifer is undifferentiated. The Chicot Aquifer is under confined conditions except in the northern part of the Houston district. Generally in southeastern Harris County and most of Galveston County, the Chicot Aquifer contains a thick sand section that has a relatively large hydraulic conductivity. This sand unit has been intensely pumped and is known locally as the Alta Loma Sand (Ref. 17, p. 3).

The Evangeline Aquifer, composed of the Goliad Sand and the upper part of the Fleming Formation, is similar in lithology to the Chicot Aquifer. One difference between the two aquifers is that the Evangeline Aquifer generally has a lower hydraulic conductivity than does the Chicot Aquifer. The contrast in hydraulic conductivity and a difference in water levels distinguishes the Evangeline Aquifer from the Chicot Aquifer (Ref. 17, p. 10). The altitude of the base of the Evangeline Aquifer ranges from 1,200 to 1,800 feet below sea level in the area of the site (Ref. 18, Section C-C'. Figure 4). The Evangeline Aquifer is typically wedge shaped and has a high sand-clay ratio. Individual sand beds are characteristically tens of feet thick. Near the outcrop the aquifer ranges in thickness from 400 to 1,000 feet, but near the coastline where the top of the aquifer is about 1,000 feet deep, its thickness averages about 2,000 feet (Ref. 18, p. 40). The Evangeline Aquifer is the major source of ground water in the Houston district. In Galveston and southern Harris Counties, water in the Evangeline Aquifer is saline and is not used (Ref. 17, p. 10).

The Burkeville confining layer separates the Jasper and overlying Evangeline Aquifers and serves to retard the interchange of water between the two aquifers. The typical thickness of the Burkeville ranges from about 300 to 500 feet. In most places, the Burkeville is composed of many individual sand layers, which contain fresh to slightly saline water. Because of its relatively large percentage of silt and clay when compared to the underlying Jasper Aquifer and overlying Evangeline Aquifer, the Burkeville functions as a confining unit (Ref. 18, p. 40).

The Jasper Aquifer is composed of interbedded sand and clay layers consisting almost entirely of terrigigenous clastic sediments. Because the Jasper Aquifer underlies shallower aquifers, withdrawals from the Jasper aquifer in terms of total withdrawals in Harris County are not significant (Ref. 17, p. 10).

The depth to shallow ground water in the area of MCC is not known.

The net precipitation for the west Houston area is 11.05 inches (Ref. 35).

The cadmium and cyanide contaminated soils at the facility pose a concern to the ground water pathway. Cadmium has a high ground water migration mobility potential. Cyanide is considered acutely toxic and poses the greatest concern to potential exposure pathways. Documentation available for ground water wells in the area indicate that most municipal wells are screened in the Evangeline and Chicot Aquifers, with depths from 200 to 1,000+ feet. A release to the ground water pathway from the soil contamination documented at MCC, is of primary concern. Further investigation would be required to determine if a release of contaminants to the shallow water-bearing units or the deeper Chicot and Evangeline Aquifers has or is occurring.

3.1.2 Ground Water Receptors

The City of Houston's potable water system is a blended system incorporating 216 wells and surface water. The City does not figure the number of connections per well because each well pumps to a respective water tank and is distributed as needed. The total population served by this system is considered to be the population of Houston within the city limits (Ref. 19). However, the west Houston area, within the city limits and outside of Loop 610 is actually on 100% ground water, while the area within the 610 Loop is on surface water (Ref. 27). The total population of the City of Houston within the principle metropolitan area is 3,182,900. The number of households in Houston is 1,196,700; which calculates to an average population per household of 2.66 (Ref. 28).

There were no municipal drinking water or irrigation wells identified within the 1 mile radius of MCC (Ref. 20, Figure 1, Table 1).

One City of Houston well (Well No. LJ-65-20-626; Appendix B) that was screened in the Evangeline Aquifer was identified within 1 to 2 miles of the site (Ref. 20, Figure 1, Table 1). Given the number of City of Houston wells (216) and the total population of the principle metropolitan area of Houston (3,182,900 people) it can be calculated that approximately 14,736 people are served by each City of Houston well, located west of the 610 Loop (Ref. 19; Ref 28).

Additionally, one well (LJ-65-20-323) that screens the Chicot Aquifer was identified within 1 to 2 miles and is used by Cornelius Nurseries, Inc. (Ref. 20, Figure 1, Table 1).

There are two City of Houston wells (LJ-65-21-148 and LJ-65-21-149) that screen the Evangeline Aquifer and one (LJ-65-21-150) that taps the Chicot Aquifer within 2 to 3 miles of the facility (Ref. 20, Figure 1, Table 1). The approximate population served by these three wells would be 14,736 X 3 = 44,208 people (Ref. 19; Ref. 28).

One drinking water well that serves Memorial Hospital and one irrigation well that serves the Houston Country Club were identified within 3 miles of the facility. Both of these wells are screened in the Evangeline Aquifer. The population served by the Memorial Hospital well was not determined (Ref. 20, Figure 1, Table 1).

One City of Houston well (Well No. LJ-65-20-226; Appendix B) was identified within 3 to 4 miles of the site (Ref. 20, Figure 1, Table 1). The well is located at the intersection of Harwin Drive and Willcrest and has been tested for arsenic due to its proximity to Crystal Chemical (TXD990707010) (Ref. 27).

The Memorial Villages Water Authority operates 6 wells with 3 water plants, that serve the communities of Piney Point Village, Hedwig Village and Hunter Creek Village. The system is interconnected serving approximately 10,028 people, with 3,045 active connections as of April 1992. The wells average 1,400 feet in depth and screen the Evangeline Aquifer. Two of the wells (Wells No. 3 and No. 53) are located approximately 2.5 miles and 2.8 miles north of MCC, respectively. Given the number of people served by the interconnected system (10,028 people), the pumping rates of individual wells (none of which exceed 40% for a single well) and the total number of wells at six; it can be estimated that approximately 1,671 people are served by each of the Memorial Village Water Authority's individual wells (Ref. 33)(Appendix B).

Additionally, the remaining four Memorial Village Water Authority wells (Wells No. 1, 2, 4 and 6) are located between 3.5 and 4.0 miles north-northeast of the MCC site (Ref. 33)(Appendix B). These four wells would serve approximately 6,684 people.

The municipality of Bunker Hill Village operates 4 wells that screen the Evangeline Aquifer and average 1,200 to 1,400 feet in depth. The system is interconnected serving approximately 3,300 people. Three of the wells (Well Nos. 1, 2 and 3) are located approximately 2.5 miles northwest of the MCC site, while Well No. 4 is located approximately 3.5 miles northwest of the site (Ref. 34)(Appendix B). The system is a 100% ground water system serving strictly residential connections. No single well in the system produces more than 40% of the total water distributed. It can be calculated that each well would serve approximately 825 people, respectively (3,300 people divided by 4 wells = 825 people per well). The municipality of Bunker Hill is not yet established in the Texas Wellhead Protection Program, but is planning to do so (Ref. 34).

According to the TWC, none of the City of Houston wells are established in the Texas Wellhead Protection Plan (Ref. 36, p. 4).

Table 1 summarizes the local water supplies located within the 4 mile target distance limit of MCC.

Ground water is used as a resource, supplying water for Cornelius Nursery, a commercial nursery (Ref. 20, Table 1). However, it is not known if the well is used for the irrigation of commercial food or forage crops.

3.2 SURFACE WATER PATHWAY

3.2.1 Surface Water Characteristics

Soils in the MCC area consist of the Bernard Urban land complex. This is a nearly level complex in broad metropolitan and rural areas where the population is increasing. The slope is 0 to 1 percent. Urban land consists of soils that have been altered or covered by buildings or other urban structures, making classification impractical. In general, this mapping unit has severe limitations for urban development. The major limitation is the high shrink-swell potential. Corrosivity to uncoated steel pipes is high (Ref. 21, p. 13). Permeability for this series is 0.06 to 0.2 inches per hour (Ref. 21, p. 118).

Runoff from the process area on-site is collected in three storm sewer grates located on the concrete apron in the front of the facility. Runoff is believed to enter into Buffalo Bayou via a series of street stormwater culverts. The overland segment is approximately 1.3 miles to the probable point of entry (PPE) into Buffalo Bayou. The 15-downstream mile segment remains in Buffalo Bayou (Appendix B).

The average flow of Buffalo Bayou is approximately 274 cubic feet per second (cfs) (Ref. 25, p. 147). The water quality of Buffalo Bayou is considered limited and is designated for non-contact recreation. Buffalo Bayou does not meet fishable or swimmable criteria due to elevated levels of fecal coliform bacteria from permitted and non-permitted outfalls and other industrial outfalls (Ref. 26, pp. 239-242).

The acreage drained by the city storm sewer system could not be determined. The two year, 24-hour rainfall potential is 4.5 to 5.0 inches (Ref. 22).

The MCC facility is situated in a Zone X flood zone. Areas within this flood zone are considered to be outside of a 500-year flood plain (Ref. 37).

No water samples were collected during the TDH investigations of MCC. MCC has undergone removal of cadmium and cyanide contaminated soils in the process area. The migration of contaminants from the site is of concern because contaminated stormwater runoff from the process areas could enter the sanitary/stormwater sewer system, eventually entering Buffalo Bayou.

3.2.2 Surface Water Receptors

Five permitted surface water intakes were identified within 15-downstream miles of the PPE on Buffalo Bayou, all of which are for irrigation. Those intakes identified are permitted primarily to country clubs with the exception of the Cinco Ranch Venture permit. It is not known if this intake

TABLE 1
MUNICIPAL DRINKING WATER SYSTEMS

Municipality/City	Well No.	Aquifer	Distance from Site*/Population Served					
			0-¼ mile	¼-½ mile	½-1 mile	1-2 miles	2-3 miles	3-4 miles
City of Houston	LJ-65-20-626	Evangeline	0	0	0	14,736	0	0
City of Houston	LJ-65-21-148	Evangeline	0	0	0	0	14,736	0
City of Houston	LJ-65-21-149	Evangeline	0	0	0	0	14,736	0
City of Houston	LJ-65-21-150	Chicot	0	0	0	0	0	14,736
City of Houston	LJ-65-20-226	Evangeline	0	0	0	0	0	14,736
Memorial Villages Water Authority	#3	Evangeline	0	0	0	0	1,671	0
Memorial Villages Water Authority	#5	Evangeline	0	0	0	0	1,671	0
Memorial Villages Water Authority	#1	Evangeline	0	0	0	0	0	1,671
Memorial Villages Water Authority	#2	Evangeline	0	0	0	0	0	1,671
Memorial Villages Water Authority	#4	Evangeline	0	0	0	0	0	1,671
Memorial Villages Water Authority	#6	Evangeline	0	0	0	0	0	1,671
Bunker Hill Village	#1	Evangeline	0	0	0	0	825	0
Bunker Hill Village	#2	Evangeline	0	0	0	0	825	0
Bunker Hill Village	#3	Evangeline	0	0	0	0	825	0
Bunker Hill Village	#4	Evangeline	0	0	0	0	0	825
		Total	0	0	0	14,7360	35,289	36,981

* (Appendix B)
(Ref. 19; Ref. 20; Ref. 27; Ref. 28; Ref. 33; Ref. 34)

is used for the irrigation of commercial livestock, commercial food crops or commercial aquaculture (Ref. 24, pp. 2-5). No drinking water intakes were identified in Buffalo Bayou.

Buffalo Bayou ranges from 20 to 90 feet wide with a depth of 6 inches to 3½ feet. Electrofishing conducted by the Texas Parks and Wildlife Department (TPW) in August 1978, indicated the presence of some sport fish (i.e., channel catfish and flathead catfish). Little evidence of fishing was observed by the TPW sampling team (Ref. 23, pp. 1-3).

No wetlands were identified within the 15-mile downstream target distance.

3.3 GROUND WATER RELEASE TO SURFACE WATER PATHWAY

The nearest perennial surface water body is greater than 1 mile north of the site (Ref. 23, p. 1)(Figure 1). Therefore, the criteria for ground water to surface pathway release is not met. A release via this pathway is unlikely and is not of primary concern.

3.4 SOIL EXPOSURE PATHWAY

The source of the soil contamination was thought to be from a ruptured tank in the plating line. The contamination occurred in 1984, before containment structures had been implemented. The area of contaminated soil was excavated until testing by the City of Houston considered it adequate (Ref. 13). Samples submitted to the TWC indicated an EP toxicity of leachable cadmium at concentrations of 13.7 ppm, 9.9 ppm and 6.65 ppm. These wastes were considered to be above allowed leachable concentration levels and were classified as hazardous waste classification D006 (Ref. 11, p. 1). The areal extent of the initial soil contamination is not known.

3.4.1 Resident Threat Receptors

There are 26 employees that work in two shifts, on-call 24 hours a day (Ref. 13). There were no residents observed living on-site, however there are residences adjacent to the property which are within 20 feet of the reported area of contamination (Ref. 13). The site is an active industrial facility. No commercial agriculture, silviculture or commercial livestock grazing occurs on-site. There were no terrestrial sensitive environments observed on-site. There were no schools or daycares observed on-site or within 200 feet of contamination (Ref. 13).

3.4.2 Nearby Threat Receptors

Site accessibility is restricted by fencing around the process area. Frequency of use is considered low and restricted to those employed by the facility (Ref. 13). The areal extent of soil contamination is not known.

Two schools, Piney Point Elementary and Lee High School were identified within 1 mile of the site (Appendix B). Piney Point Elementary is located within ¼ to ½ mile of MCC and has an enrollment of 654 students (Figure 1)(Ref. 29). Lee High School is located within ½ to 1 mile of MCC and has an enrollment of approximately 2,500 students (Figure 1) (Ref. 30).

The USEPA Geographical Exposure Modeling System (GEMS) Database was consulted to determine the number of individuals residing within 1 mile of MCC. Information from the database indicate that there are approximately 1,171 people residing or attending schools within 0 to ¼ mile of MCC; 3,553 people residing or attending schools within ¼ to ½ mile of MCC; and approximately 10,500 people residing or attending schools within ½ to 1 mile of MCC (Ref. 29; Ref. 30; Ref. 31).

3.5 AIR PATHWAY

3.5.1 Air Pathway Characteristics

Heavy metals associated with surface soil contamination have been documented on-site. The areal extent of soil contamination is not known. There have been no air samples collected at the MCC property; thus, an observed release to the air pathway can not be documented.

Due to the presence of the open vats of caustic cleaning solutions and the operating evaporator tank, a potential for gaseous migration of volatiles, caustic and cyanide related fumes and vapors exist. Vapors and fumes were observed, releasing from the evaporator tank during the on-site visit (Appendix A, Photograph 3). Contaminated soil at MCC has been removed, reducing the potential for particulate migration.

3.5.2 Air Receptors

The USEPA GEMS database was consulted to determine the number of people residing within the 4-mile target distance limit of the site. The number of people residing and attending schools within 0 to ¼ mile is 1,171; within ¼ to ½ mile is 3,553; within ½ to 1 mile is 10,500 (Ref. 29; Ref. 30; Ref. 31). The number of people residing within 1 to 2 miles is 56,807; within 2 to 3 miles is 75,792 and within 3 to 4 miles is 92,440 (Ref. 31). The number of students attending schools 1 to 4 miles from the site was not determined; however, there were 37 schools identified within a 1 to 4 mile radius of the site (Appendix B).

An endangered plant, Hymenoxys texana; Texas Bitterweed, was identified as having known populations present in western Harris County (Ref. 32, pp. 83, 84).

Further investigation would be required to determine if any federally designated wetlands exist within the 4-mile target distance limit.

The site is located in a predominantly commercial and residential area (Appendix B). No commercial agriculture, commercial silviculture or designated recreational areas were identified within ½ mile of the site (Appendix B).

4.0 SUMMARY

MCC is located at 3720 Dunvale Avenue on the west side of the Houston Metroplex, near the municipalities of Bellaire, Piney Point Village and Bunker Hill Village. MCC is a generator of hazardous wastes code F006 and D006, which result from electroplating operations. The electroplating processes involve consecutive washes and emulsions in water, sulfuric acid, hydrochloric acid, cyanide baths and phosphate solutions. Rinse waters from the tanks are removed approximately once a week by a diaphragm pump into holding tanks and eventually introduced into the 2,000 gallon evaporator tank. Waste sludges are currently disposed off-site after they are de-watered.

MCC reported to the TWC on October 4, 1988, that the facility was working on the removal of soil which had been contaminated with spent acid and caustic cleaner sludges. The cause of the contamination was evidently due to a ruptured tank in the cadmium plating line sometime in 1984. The City of Houston conducted soil testing on July 15, 1988 in the contaminated area and found that concentrations of cadmium were considered to be above EP Toxicity standards. The areas of contaminated soil under went removal until testing by the city deemed the clean-up action adequate.

The contaminated soil that was reported at MCC in 1988 was excavated and stored in drums. The amount stored in the facility was approximately 4 to 6 cubic yards. Mr. Rountree contracted Chemical Waste Management, Inc., Carlyss, Louisiana to begin the removal in November 1990. Chemical Waste Management, Inc. ran profiles on the wastes to be accepted and collected three of the five roll out containers of F006 sludges that had been mixed with the 4 to 6 cubic yards of contaminated soil. The remaining two roll out containers of waste were considered to have concentrations of cyanide too high to except. Mr. Rountree contracted Horsehead Resource Development Company, Inc. to remove the remaining amount of accumulated F006 sludge wastes and the remaining cadmium and cyanide contaminated soils

The primary pathways of concern are the ground water, surface water and air migration pathways. Analyses of soil samples collected by the City of Houston from the area of soil contamination indicated the presence of heavy metals especially cadmium, cyanide, other heavy metals and caustic solutions associated with the now inactive cadmium plating line.

The ground water pathway is of primary concern, due to the nature of the contaminants detected and the potential population being served by ground water. Cadmium is considered to posses very high ground water mobility characteristic. Although, there were no municipal drinking water wells identified within 1 mile of the facility, 15 wells were identified within the 4 mile target distance limit. The total population served by the wells identified is 87,006.

The surface water pathway is of concern because of the poor integrity and containment structures associated with current site operations. There is the potential for stormwater runoff to become contaminated with materials associated with the existing plating lines, including the cyanide bath solutions, and enter into the sanitary sewer/stormwater system.

The air pathway is of concern because potentially caustic and toxic fumes from the sludge evaporator are uncontrolled and are readily available for the air migration pathway.

An endangered plant species, the Texas Bitterweed, is known to occur in the western Harris County area.

The following data gaps were encountered during the completion of this assessment:

- The dimensions of the area of soil contamination reported in 1988. The volume of cadmium and cyanide contaminated soils that were removed from 1989 to 1991 was estimated to be 4 to 6 cubic yards;

- The population served by the Memorial Hospital ground water well;
- If any commercial agriculture, commercial livestock production or silviculture occurs within 4 miles of the MCC facility;
- The acreage drained by the city sanitary/stormwater sewer system and the exact PPE into Buffalo Bayou;
- If any wetlands exist within the 15-mile downstream segment in Buffalo Bayou;
- If any wetlands exist within the 4-mile target distance limit.

APPENDIX A

ICF TECHNOLOGY INCORPORATED

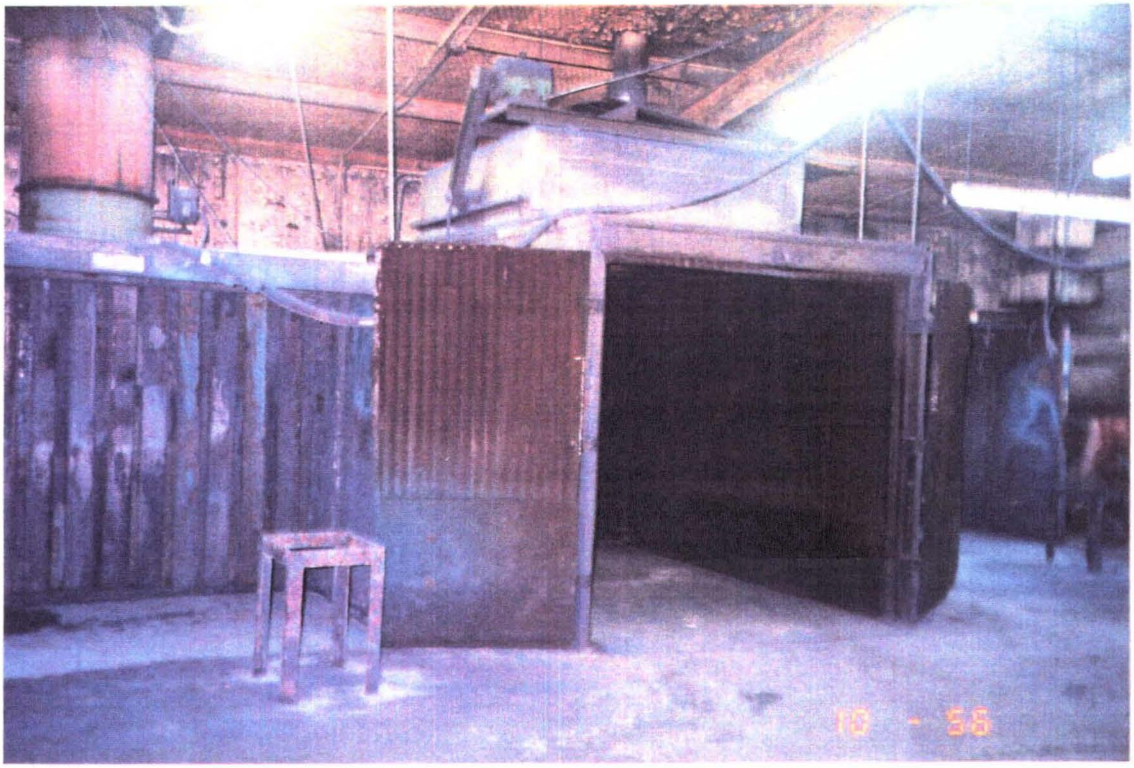

PHOTO. # 1

NEG. # 16

SITE NAME METAL COATINGS CORPORATION

SITE LOCATION HOUSTON, TEXAS

CERCLIS # TXD072181969 PROJECT # 37631-012-01

PHOTOGRAPHER KEVIN JAYNES WITNESS THOMAS RITCHIE

DATE 02-04-92 TIME 1056 DIRECTION N/A

COMMENTS OVERSPRAY BOOTHS

ICF TECHNOLOGY INCORPORATED

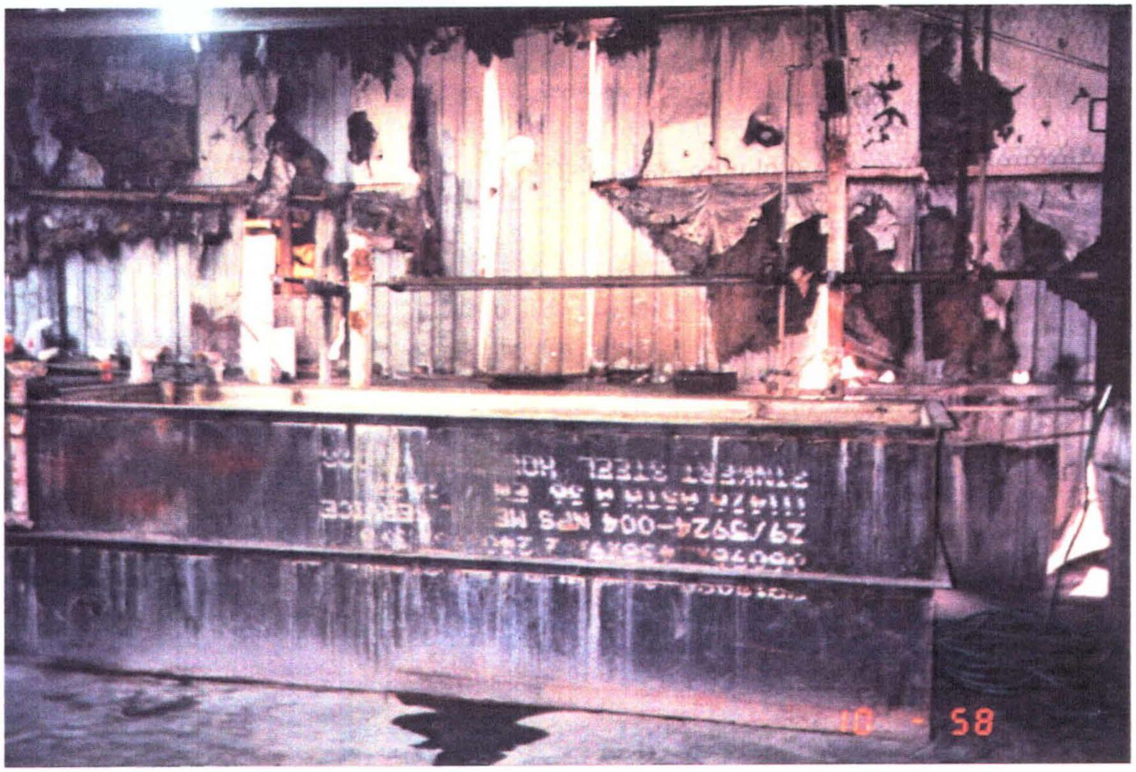

PHOTO.
2
NEG. # 17

SITE NAME: METAL COATINGS CORPORATION

SITE LOCATION: HOUSTON, TEXAS

CERCLIS #: TXD072181969 | PROJECT #: 37631-012-01

PHOTOGRAPHER: KEVIN JAYNES | WITNESS: THOMAS RITCHIE

DATE: 02-04-92 | TIME: 1058 | DIRECTION: N/A

COMMENTS: 2000 GALLON PHOSPHATING SOLUTION TANK.

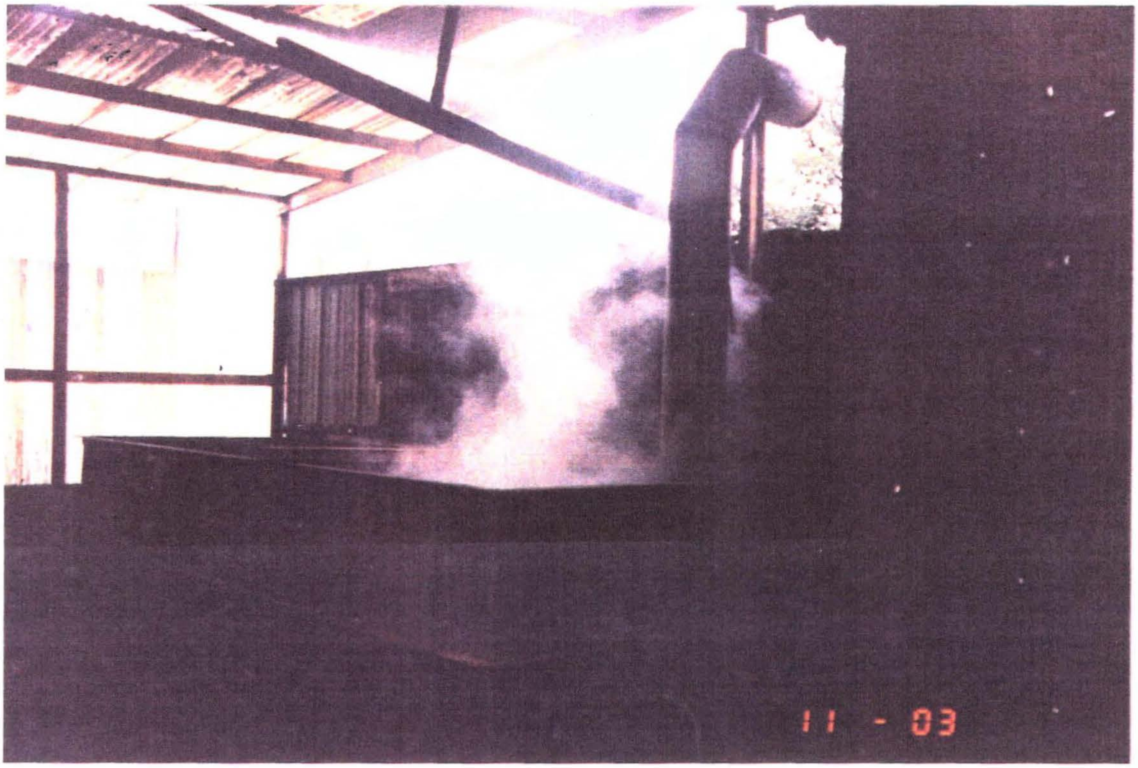

PHOTO.
3
NEG. # 18

SITE NAME	METAL COATINGS CORPORATION		
SITE LOCATION	HOUSTON, TEXAS		
CERCLIS #	TXD072181969	PROJECT #	37631-012-01
PHOTOGRAPHER	KEVIN JAYNES Kevin Jaynes	WITNESS	THOMAS RITCHIE Thomas Ritchie
DATE	02-04-92 TIME 1103	DIRECTION	N/A
COMMENTS	2000 GALLON WASHWATER / SLUDGE EVAPORATOR TANK.		

PHOTO.
4
NEG. # 19

SITE NAME METAL COATINGS CORPORATION
SITE LOCATION HOUSTON, TEXAS
CERCLIS # TXD072181969 PROJECT # 37631-012-01
PHOTOGRAPHER KEVIN JAYNES Kevin Jaynes WITNESS THOMAS RITCHIE Thomas Ritchie
DATE 02-04-92 TIME 1108 DIRECTION N/A
COMMENTS ZINC AND PHOSPHATE ELECTROPLATING LINE.

ICF TECHNOLOGY INCORPORATED

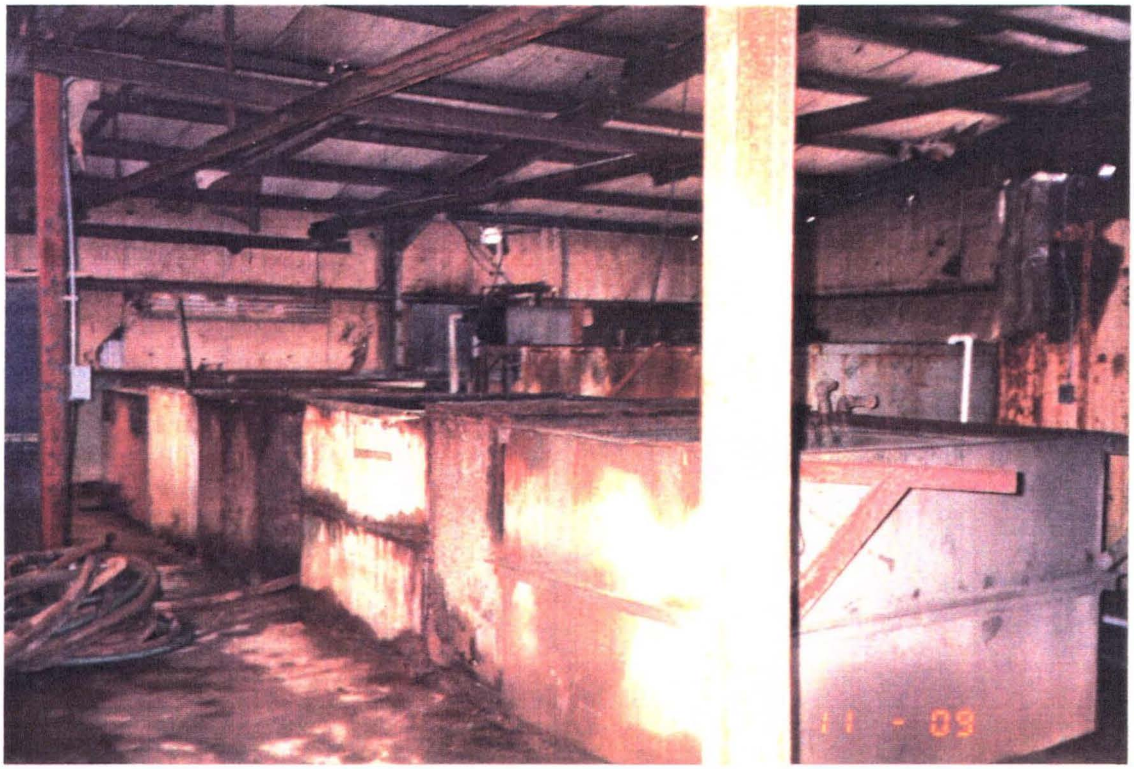

PHOTO.
5
NEG. # 20

SITE NAME: METAL COATINGS CORPORATION

SITE LOCATION: HOUSTON, TEXAS

CERCLIS #: TXD072181969 PROJECT #: 37631-012-01

PHOTOGRAPHER: KEVIN JAYNES Kevin Jaynes WITNESS: THOMAS RITCHIE Thomas Ritchie

DATE: 02-04-92 TIME: 1109 DIRECTION: N/A

COMMENTS: OLD CADMIUM PLATING LINE. THIS PROCESS LINE IS NO LONGER USED.

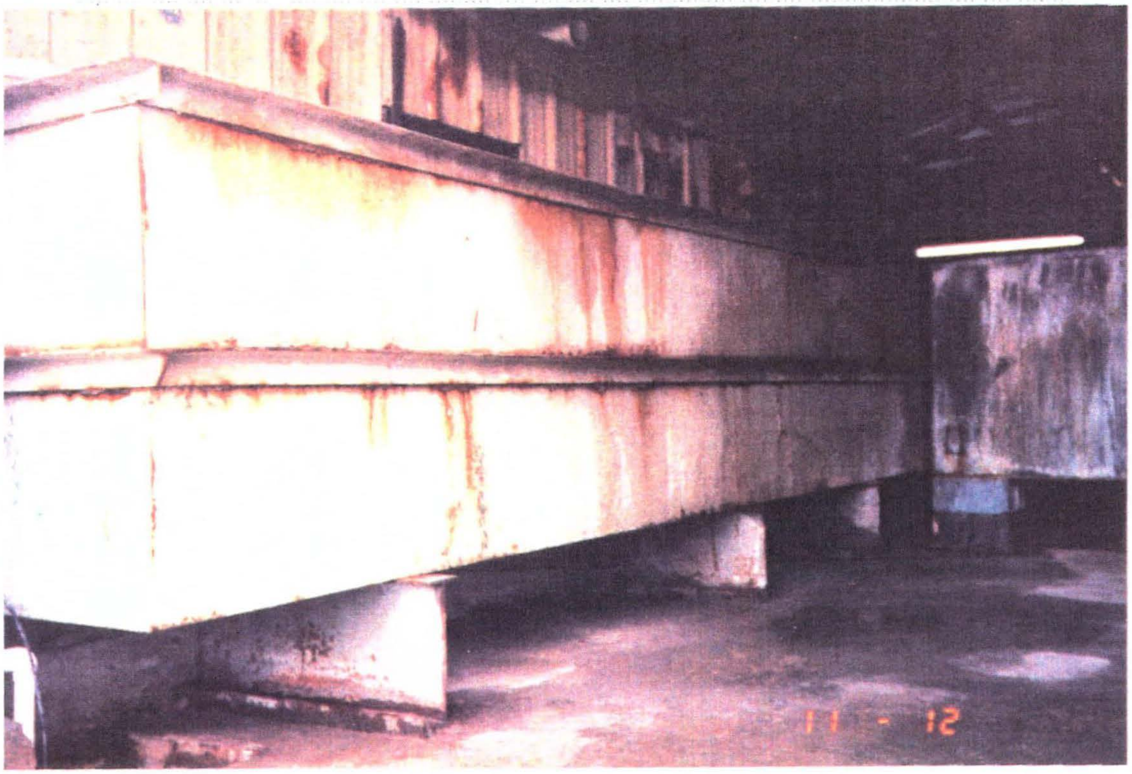

PHOTO.
6
NEG. # 21

SITE NAME METAL COATINGS CORPORATION

SITE LOCATION HOUSTON, TEXAS

CERCLIS # TXD072181969 PROJECT # 37631-012-01

PHOTOGRAPHER KEVIN JAYNES WITNESS THOMAS RITCHIE

DATE 02-04-92 TIME 1112 DIRECTION N/A

COMMENTS OLD PERMITTED TANK, NOW USED TO COLLECT RUNOFF FROM THE PROCESS AREAS.

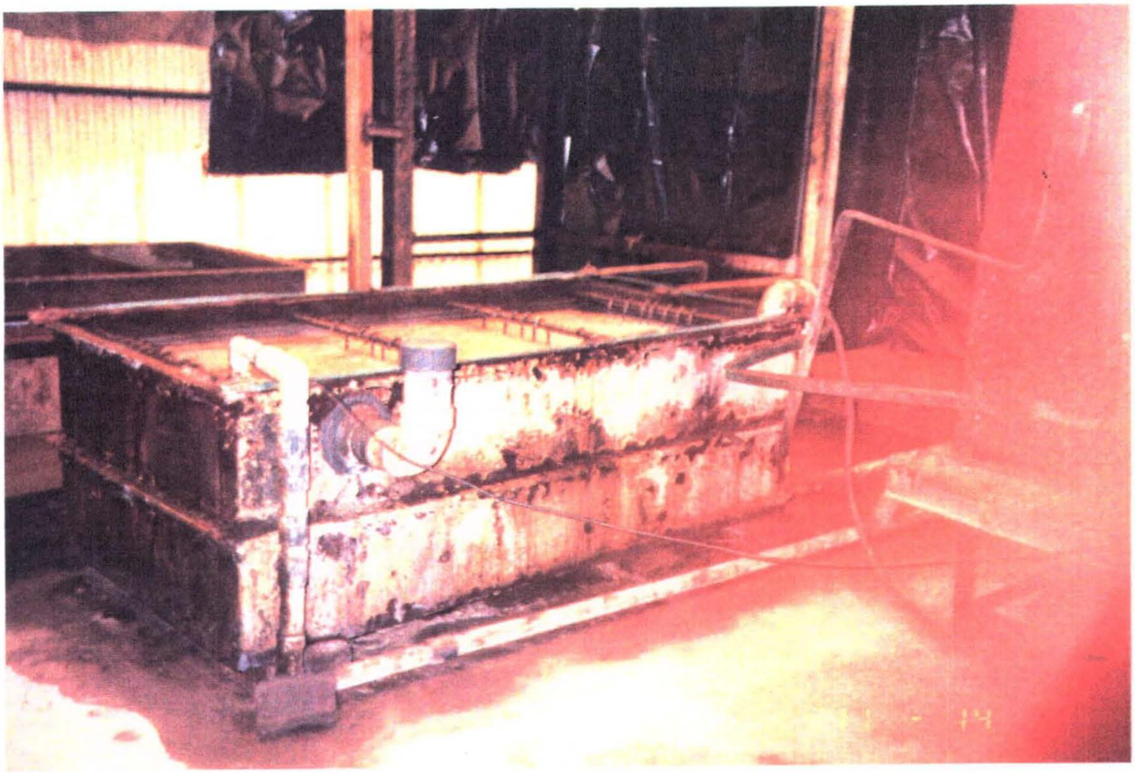

PHOTO.
7
NEG. # 22

SITE NAME METAL COATINGS CORPORATION

SITE LOCATION HOUSTON, TEXAS

CERCLIS # TXD072181969 PROJECT # 37631-012-01

PHOTOGRAPHER KEVIN JAYNES Kevin Jaynes WITNESS THOMAS RITCHIE Thomas Ritchie

DATE 02-04-92 TIME 1114 DIRECTION N/A

COMMENTS CYANIDE SOLUTION PLATING TANK.

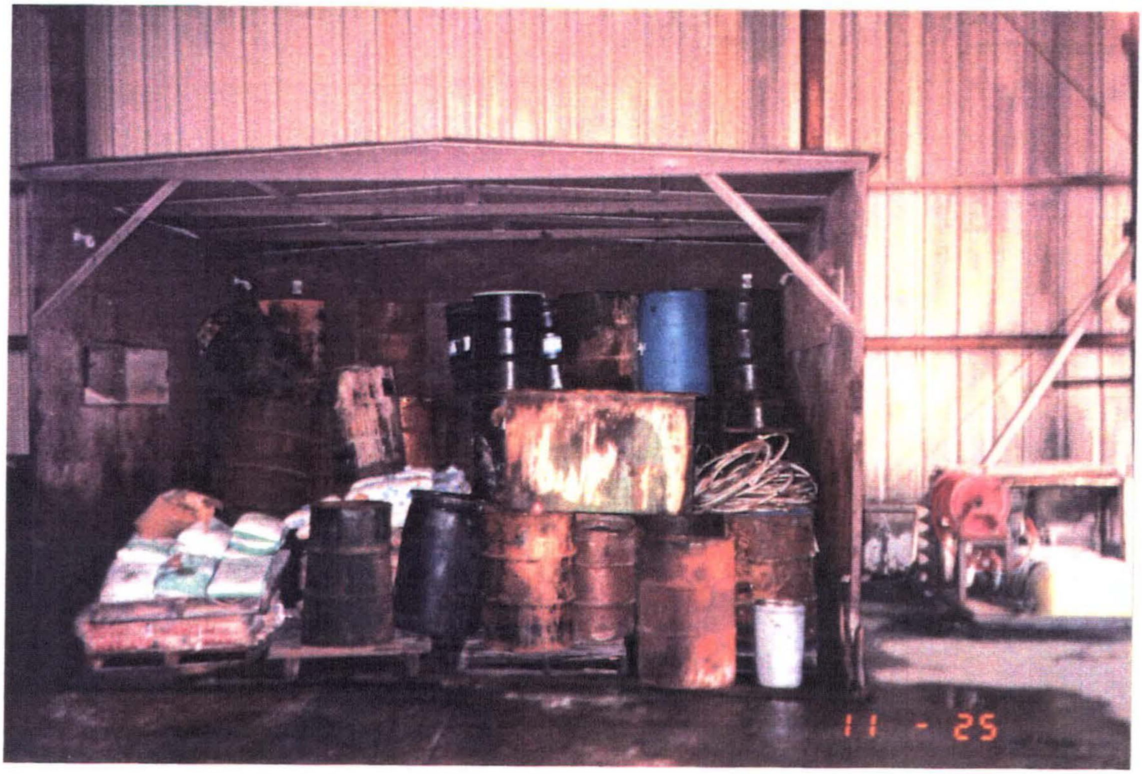

PHOTO.
8
NEG. # 23

SITE NAME METAL COATINGS CORPORATION

SITE LOCATION HOUSTON, TEXAS

CERCLIS # TXD072181969 PROJECT # 37631-012-01

PHOTOGRAPHER KEVIN JAYNES WITNESS THOMAS RITCHIE

DATE 02-04-92 TIME 1125 DIRECTION N/A

COMMENTS SHED - WITHIN - A - SHED REFUSE STORAGE AREA.

APPENDIX B

N

0 2000

SCALE 1 : 24000

FOUR MILE TARGET DISTANCE LIMIT

METAL COATINGS CORPORATION

HOUSTON, TEXAS

TXD072181969

TEXAS

QUADRANGLES

ALIEF, TX

BELLAIRE, TX

HEDWIG VILLAGE, TX

HOUSTON HEIGHTS, TX

PA DOCUMENTATION LOG SHEET

SITE: METAL COATINGS CORPORATION
IDENTIFICATION NUMBER: ID #TXD072181969
CITY: HOUSTON
STATE: TEXAS

REFERENCE NUMBER	DESCRIPTION OF THE REFERENCE
1	EPA Form 3510-1 and 3510-3. General Information and Hazardous Waste Permit Application. Metal Coatings Corporation. November 17, 1980. TXD072181969.
2	Texas Department of Water Resources. Complaint Report. Metal Coatings Corporation. February 7, 1985.
3	Permit for Industrial Solid Waste Management Site. Texas Water Commission. Hazardous Waste Permit Number HW-50017-000. Metal Coatings Corporation. February 26, 1985.
4	Letter. Changes to Solid Waste Registration. From: Thomas M. Tiller, Engineering, TechnoEquip. To: Permits Division, Texas Water Commission. December 4, 1985. TXD072181969.
5	Consent To Revocation Of Texas Water Commission Permit. Metal Coatings Corporation. April 14, 1986.
6	Letter. Full Facility Closure, Hazardous Waste Permit No. HW-50017-000. From: Kelly L. Meloy, Head, Facility Unit I, Hazardous Solid Waste Permits Section, Texas Water Commission. To: Mike Rountree, Metal Coatings Corporation. September 16, 1986.
7	Letter. Metal Coatings Corporation, Revocation of Hazardous Waste Permit No. HW-50017-000. From: Thomas M. Tiller, P.E., TechnoEquip. To: Minor Hibbs, Permit Division, Texas Water Commission. December 17, 1986. Attachments.
8	Letter. Metal Coatings Corporation, Revocation of Hazardous Waste Permit No. HW-50017-000. From: Larry Soward, Executive Director, Texas Water Commission. To: Michael Rountree, Vice President, Metal Coatings Corporation. January 6, 1987.
9	Letter. Amendments to Notice of Registration. From: Mike Rountree, Metal Coatings Corporation. To: Ed Hatton, Texas Water Commission. September 28, 1988.

10 Letter. Waste Classification. From: M. H. Rountree, Manager, Metal Coatings Corporation. To: Glen Davis, Texas Water Commission. October 4, 1988. Attachments.

11 Letter. Solid Waste Registration Number 31596. From: E. V. Hatton, Head, Compliance Assistance Unit, Hazardous and Solid Waste Division, Texas Water Commission. To: M. H. Rountree, Metal Coatings Corporation. November 23, 1988.

12 Code of Federal Regulations. 40 CFR, Parts 260 to 299, Section 261.24. Revised as of July 1, 1990.

13 Memorandum. Summary of On-Site Reconnaissance Inspection. From: Kevin Jaynes, ICF Technology, Inc. To: File. February 6, 1992. TXD072181969.

14 Texas Water Commission Notice of Registration Solid Waste Management. Metal Coatings Corporation. May 16, 1990. TXD072181969.

15 Uniform Hazardous Waste Manifests. State of Louisiana Department of Environmental Quality and Texas Water Commission. Metal Coatings Corporation. April 10, 1991; April 11, 1991; December 16, 1991; January 13, 1992; January 13, 1992; January 30, 1992 and February 2, 1992.

16 Carr, Jerry E., et.al, Digital Models For Simulation Of Ground Water Hydrology Of The Chicot And Evangeline Aquifers Along The Gulf Coast Of Texas. Texas Department of Water Resources Report 289. U.S. Geological Survey. May 1985.

17 Ground Water Withdrawals And Changes In Ground Water Levels, Ground Water Quality, And Land Surface Subsidence In The Houston District, Texas, 1980-84. U.S. Geological Survey Water-Resources Investigations Report 87-4153. Prepared in Cooperation With The City Of Houston and the Harris-Galveston Coastal Subsidence District.

18 Baker, E. T., Jr. Stratigraphic And Hydrogeologic Framework Of Part Of The Coastal Plain Of Texas. Texas Department of Water Resources Report 236. U.S. Geological Survey. July 1979.

19 Record of Communication. West Houston Ground Water Wells. From: Kevin Jaynes, Site Manager, ICF Technology, Inc. To: City of Houston Water Engineering Department. May 11, 1992. TXD072181969.

20	Williams, James F., et. al, Records of Wells, Driller's Logs, Water-Level Measurements, And Chemical Analyses Of Ground Water In Harris And Galveston Counties, Texas, 1980-84. U.S. Geological Survey Open-File Report 98-378. Prepared in Cooperation With The City of Houston and the Harris-Galveston Coastal Subsidence District. 1987.
21	Soil Survey of Harris County, Texas. United States Department of Agriculture Soil Conservation Service in Cooperation with the Texas Agricultural Experiment Station and the Harris County Flood Control District. August 1976.
22	Hershfield, David M. Rainfall Frequency Atlas of the Unites States. Technical Paper No. 40. May 1961.
23	Letter. Fishery of Buffalo Bayou. From: Mark A. Webb, District Management Supervisor, Texas Parks and Wildlife Department. To: Kim Birdsall, ICF Technology, Inc. July 9, 1991.
24	Facsimile Transmission. Surface Water Permit Status. From: Arlette Capehart, Texas Water Commission. To: Kim Birdsall, ICF Technology, Inc. July 8, 1991.
25	Water Resources Data Texas Water Year 1987. Volume 2. U.S. Geological Survey Water Data Report TX-87-2.
26	The State Of Texas Water Quality Inventory, 9th Edition 1988. Texas Water Commission. April 1988.
27	Record of Communication. West Houston Water. From: Charles Leideigh, Harris County Engineering Division. To: Kevin Jaynes, Site Manager, ICF Technology, Inc. May 8, 1992. TXD072181969.
28	Record of Communication. Population Density of the Houston/Harris County, TX Area. From: Luis Vega, FIT Biologist, ICF Technology, Inc. To: Kay Hodges, Chamber of Commerce, Houston, Texas. November 30, 1989.
29	Record of Communication. Enrollment at Piney Point Elementary. From: Kevin Jaynes, Site Manager, ICF Technology, Inc. To: Ms. Cantu, Secretary, Piney Point Elementary, Houston, Texas. May 8, 1992. TXD072181969.
30	Record of Communication. Enrollment at Lee High School. From: Kevin Jaynes, Site Manager, ICF Technology, Inc. To: Judy Harris, Secretary to the Principal, Robert E. Lee High School, Houston, Texas. May 8, 1992. TXD072181969.

31 U.S. Environmental Protection Agency, Geographical Exposure Modeling System (GEMS) database, compiled from U.S. Census Bureau 1980 data, accessed February 10, 1992.

32 Endangered and Threatened Species of Texas and Oklahoma 1987. U.S. Fish and Wildlife Service.

33 Record of Communication. Memorial Villages Water Authority, West Houston. From: Kevin Jaynes, Site Manager, ICF Technology, Inc. To: Mike Montgomery, Water Manager, Memorial Villages Water Authority. May 12, 1992. TXD072181969.

34 Record of Communication. Bunker Hill Municipal Water System. From: Kevin Jaynes, Site Manager, ICF Technology, Inc. To: David Eby, City Administrator, Bunker Hill Village. May 12, 1992. TXD072181969.

35 Letter. HRS Net Precipitation Values. From: Andrew M. Platt, Group Leader, MITRE Corporation. To: Lucy Sibold, U.S. Environmental Protection Agency. May 26, 1988.

36 Letter. Texas' Wellhead Protection (WHP) Program. From: David P. Terry, M.En., Ground Water Section, Texas Water Commission. To: Alex Zocchi, ICF Kaiser Engineers. July 15, 1991.

37 National Flood Insurance Program, Flood Insurance Rate Map. Harris County, Texas and Incorporated Areas. Panel 275 of 390. Map Number 48201C0275 G. September 28, 1990.

REFERENCE 1

type in the unshaded areas only
... are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-R0175

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY
GENERAL INFORMATION
Consolidated Permits Program
(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

T X D0 7 21 8 19 6 9

I. EPA I.D. NUMBER

III. FACILITY NAME

V. FACILITY MAILING ADDRESS

VI. FACILITY LOCATION

PLEASE PLACE LABEL IN THIS SPACE

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill–in area below. Also, if any of the preprinted data is absent (*the area to the left of the label space lists the information that should appear*), please provide it in the proper fill–in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI (*except VI-B which must be completed regardless*). Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold–faced terms.

SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED
A. Is this facility a publicly owned treatment works which results in a discharge to waters of the U.S.? (FORM 2A)		X		B. Does or will this facility (either existing or proposed) include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to waters of the U.S.? (FORM 2B)		X	
C. Is this a facility which currently results in discharges to waters of the U.S. other than those described in A or B above? (FORM 2C)		X		D. Is this a proposed facility (other than those described in A or B above) which will result in a discharge to waters of the U.S.? (FORM 2D)		X	
E. Does or will this facility treat, store, or dispose of hazardous wastes? (FORM 3)	X			F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
I. Is this facility a proposed stationary source which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X		J. Is this facility a proposed stationary source which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X	

III. NAME OF FACILITY

1 SKIP M E TA L C O AT I N GS C O RP

IV. FACILITY CONTACT

A. NAME & TITLE (last, first, & title)	B. PHONE (area code & no.)		
2 M U LL E N TH O M AS PR E SI D EN T	7 13	9 77	0 123

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX

3 P O B O X 3 64 0 7

B. CITY OR TOWN	C. STATE	D. ZIP CODE
4 H O US T ON	TX	7 70 36

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER

5 3 7 00 D UN V AL=E

B. COUNTY NAME

H AR R I S

C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE (if known)
6 HO U S TO=N	T X	7 7 03 6	

RECEIVED
NOV 19 1980

CONTINUED FROM THE FRONT

VII. SIC CODES (4-digit, in order of priority)

A. FIRST		B. SECOND	
3471	(specify) ELECTROPLATING OF METALS & FORMED PRODUCTS		(specify)
C. THIRD		**D. FOURTH**	
	(specify)		(specify)

VIII. OPERATOR INFORMATION

A. NAME: METAL COATINGS CORP

B. Is the name listed in Item VIII-A also the owner? [X] YES [ ] NO

C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box; if "Other", specify.)
F = FEDERAL, S = STATE, P = PRIVATE, M = PUBLIC (other than federal or state), O = OTHER (specify)

P (specify)

D. PHONE (area code & no.): 713 977 0123

E. STREET OR P.O. BOX: PO BOX 36407

F. CITY OR TOWN	G. STATE	H. ZIP CODE
HOUSTON	TX	77036

IX. INDIAN LAND

Is the facility located on Indian lands? [ ] YES [X] NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water)	D. PSD (Air Emissions from Proposed Sources)	
9 N NA	9 P NA	
B. UIC (Underground Injection of Fluids)	**E. OTHER (specify)**	
9 U NA	9 M 11279	(specify) CITY OF HOUSTON
C. RCRA (Hazardous Wastes)	**E. OTHER (specify)**	
9 R NA	9	(specify)

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

F9: A/50

XII. NATURE OF BUSINESS (provide a brief description)

APPLICATION OF PROTECTIVE COATINGS TO FORMED METAL PARTS.
CONSISTING OF SPRAY AND HAND APPLIED PAINT PRODUCTS AND
ELECTROPLATING OF CADMIUM & ZINC.

F9: A/51

XIII. CERTIFICATION (see instructions)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)	B. SIGNATURE	C. DATE SIGNED
THOMAS MULLEN, PRESIDENT	Thomas Mullen	11/17/80

COMMENTS FOR OFFICIAL USE ONLY

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…orm Approved OMB No. 158-S80004

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY
HAZARDOUS WASTE PERMIT APPLICATION
Consolidated Permits Program
(This information is required under Section 3005 of RCRA.)

I. EPA I.D. NUMBER

												T/A	C
F	T	X	D	0	7	2	1 8	1	9 6	9		3	1

…OFFICIAL USE ONLY

…PLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS
	8 0 1 1 1 9	

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below *(mark one box only)* to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

A. FIRST APPLICATION *(place an "X" below and provide the appropriate date)*

[X] 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

[ ] 2. NEW FACILITY *(Complete item below.)*

C	YR.	MO.	DAY
8	8 0	0 3	0 1

FOR EXISTING FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*

YR.	MO.	DAY

FOR NEW FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR IS EXPECTED TO BEGIN

B. REVISED APPLICATION *(place an "X" below and complete Item I above)*

[ ] 1. FACILITY HAS INTERIM STATUS

[ ] 2. FACILITY HAS A RCRA PERMIT

III. PROCESSES – CODES AND DESIGN CAPACITIES

A. PROCESS CODE — Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process *(including its design capacity)* in the space provided on the form *(Item III-C)*.

B. PROCESS DESIGN CAPACITY — For each code entered in column A enter the capacity of the process.
1. AMOUNT — Enter the amount.
2. UNIT OF MEASURE — For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER *(barrel, drum, etc.)*	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER *(Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)*	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G	LITERS PER DAY	V	ACRE-FEET	A
LITERS	L	TONS PER HOUR	D	HECTARE-METER	F
CUBIC YARDS	Y	METRIC TONS PER HOUR	W	ACRES	B
CUBIC METERS	C	GALLONS PER HOUR	E	HECTARES	Q
GALLONS PER DAY	U	LITERS PER HOUR	H		

EXAMPLE FOR COMPLETING ITEM III *(shown in line numbers X-1 and X-2 below)*: A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

C	DUP	T/A	C 1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
~~X-1~~	~~S 0 2~~	~~600~~	~~G~~		5				
~~X-2~~	~~T 0 3~~	~~20~~	~~E~~		6				
1	~~S0 2~~	~~2625~~	~~G~~		7				
2	S 0 2	5 260.000 ~~2625~~	G		8				
3					9				
4					10				

Continued from the front.

III. PROCESSES *(continued)*

C. SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESSES *(code "T04")*. FOR EACH PROCESS ENTERED HE[RE] INCLUDE DESIGN CAPACITY.

IV. DESCRIPTION OF HAZARDOUS WASTES

A. **EPA HAZARDOUS WASTE NUMBER** — Enter the four–digit number from 40 CFR, Subpart D for each listed hazardous waste you will handle. If you handle hazardous wastes which are not listed in 40 CFR, Subpart D, enter the four–digit number*(s)* from 40 CFR, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.

B. **ESTIMATED ANNUAL QUANTITY** — For each **listed waste** entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each **characteristic** or **toxic contaminant** entered in column A estimate the total annual quantity of all the non–listed waste*(s)* that will be handled which possess that characteristic or contaminant.

C. **UNIT OF MEASURE** — For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. **PROCESSES**

1. PROCESS CODES:
   For listed hazardous waste: For each **listed** hazardous waste entered in column A select the code*(s)* from the list of process codes contained in Item III to indicate how the waste will be stored, treated, and/or disposed of at the facility.
   For non–listed hazardous wastes: For each characteristic or toxic contaminant entered in column A, select the code*(s)* from the list of process codes contained in Item III to indicate **all** the processes that will be used to store, treat, and/or dispose of all the non–listed hazardous wastes that possess that characteristic or toxic contaminant.
   Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code*(s)*.
2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER — Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

1. Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B, C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other EPA Hazardous Waste Number that can be used to describe the hazardous waste.

EXAMPLE FOR COMPLETING ITEM IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* — A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non–listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. EPA HAZARD. WASTE NO *(enter code)*	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE *(enter code)*	D. PROCESSES 1. PROCESS CODES *(enter)*	D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
~~X-1~~	~~K 0 5 4~~	~~900~~	~~P~~	~~T 0 3 D 8 0~~	
~~X-2~~	~~D 0 0 2~~	~~400~~	~~P~~	~~T 0 3 D 8 0~~	
~~X-3~~	~~D 0 0 1~~	~~100~~	~~P~~	~~T 0 3 D 8 0~~	
~~X-4~~	~~D 0 0 2~~				*included with above*

CONTINUE ON PAGE 3

...m page 2.
...tocopy this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1): T X D 0 7 2 1 8 1 9 6 9 | T/A: 3 | C: 1

FOR OFFICIAL USE ONLY: W | DUP | T/A: | C: 2 | DUP

V. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	F 0 0 7	90,300.000	P	S 02	SEE ATTACHED STATE SUBMISSION
2	~~F 0 0 9~~	~~-0-~~	~~P~~	~~S 02~~	" " "
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					

Continued from the front.

IV. DESCRIPTION OF HAZARDOUS WASTES *(continued)*

E. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

EPA I.D. NO. *(enter from page 1)*

F TXD072181969 3 6

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail).* F6: 55

VI. PHOTOGRAPHS

All existing facilities must include photographs *(aerial or ground–level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail).* F6: A/56

VII. FACILITY GEOGRAPHIC LOCATION

LATITUDE *(degrees, minutes, & seconds)*	LONGITUDE *(degrees, minutes, & seconds)*
29 43 490	095 30 590

VIII. FACILITY OWNER

[X] A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. *(area code & no.)*
E	

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE
F	G		

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED
THOMAS MULLEN	Thomas Mullen	11/17/80

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED

 CONTINUE ON PAGE 5

Metal Coatings Corp.
THE APPLICATORS

P.O. BOX 36407 • HOUSTON, TEXAS 77036 • (713) 977-0123

REFERENCE 2

TEXAS DEPARTMENT OF WATER RESOURCES

COMPLAINT REPORT
DISTRICT 7

31596

Date Complaint Rec'd: February 5, 1985 Source: telephone

COMPLAINANT EF8502195

Name: - Anonymous -

Address:

City, State, Zip:

Telephone:

TYPE	
Pollution, Surface Water	✓
Pollution, Ground Water	
Solid Waste	✓
Water Rights	
Others	

Location: Metal Coatings Corp., 3720 Dunvale, Houston

Alleged Problem: The company washes off equipment directly onto the ground and the washwater drains into the storm sewer located on Dunvale. The complainant also noted strong solvent odors in the area.

Summary of Investigation: Conducted investigation on 02/06/85, 10:00am, and spoke with Mike Roundtree, plant manager of Metal Coatings Corp. He stated that the only equipment they have which can be outside is a forklift, an air compressor, and the trucks which they lease from →

☐ Interim Status of Corrective Action if problem is not yet resolved.

☒ Final Resolution of Problem: No further action deemed necessary.

Date and method of complainant notification: n/a - was an anonymous complaint.

County: Harris Segment No. 91

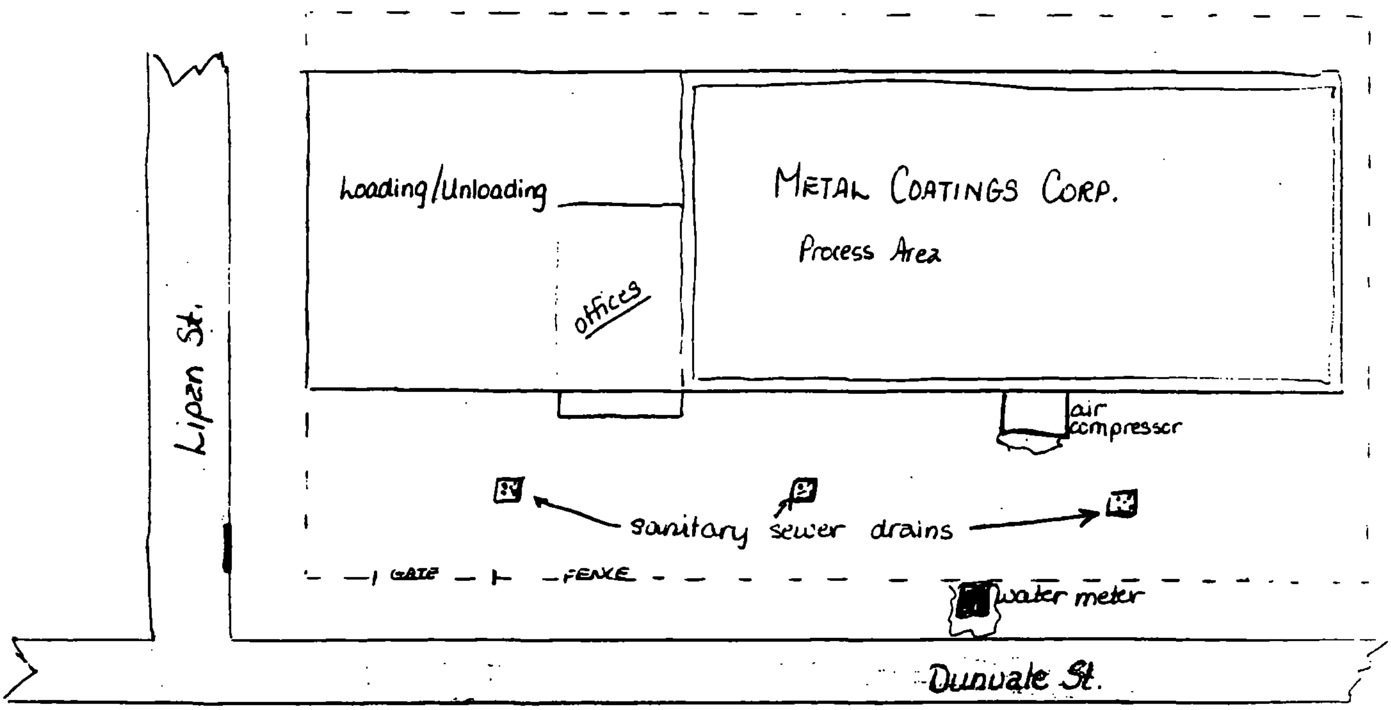
Signature of Investigator: Karen L. Bleam MJC

River Basin: San Jacinto [redacted]

Date: 02-07-85

TDWR-0264 (Rev. 11-16-81)

Ryder. The air compressor was leaking some oil, but this drained into their sanitary sewer which is permitted by the City of Houston. There were no storm drains on Dunvale near the company, and no evidence of washwater was noted. Anything washed on Metal Coatings property would drain into their sanitary sewer. (see diagram). Mr. Roundtree stated that they sometimes bail out the water meter in front of their property to read the meter.



REFERENCE 3

31546

PERM... NO. HW-50017-000

TEXAS WATER COMMISSION
Stephen F. Austin State Office Building
Austin, Texas

PERMIT FOR INDUSTRIAL SOLID WASTE MANAGEMENT SITE
issued under provisions of TEX. REV. CIV. STAT. ANN. art. 4477-7 and Chapter 26 of the Texas Water Code

Name of Permittee:	Metal Coatings Corporation 3720 Dunvale Houston, Texas 77063
Site Owner:	Metal Coatings Corporation 3720 Dunvale Houston, Texas 77063
Registered Agent for Service:	Thomas Mullen P. O. Box 36407 Houston, Texas 77036
Classification of Site:	On-site Hazardous Waste Storage

The permittee is authorized to store wastes in accordance with limitations, requirements and other conditions set forth herein. This permit is granted subject to the rules of the Department and other Orders of the Commission and laws of the State of Texas. Nothing in this permit exempts the permittee from compliance with the applicable rules and regulations of the Texas Air Control Board.

This permit will be valid until cancelled, amended or revoked by the Commission, except that the authorization to receive wastes shall expire midnight, ten years after the date of permit approval.

APPROVED, ISSUED, AND EFFECTIVE this 26th day of February, 19 85.

ATTEST: Mary Ann Hefner

Paul Hopkins
For the Commission

TDWR-0080 A

NAME: Metal Coatings Corporation

I. Size and Location of Site

The industrial solid waste facility is located approximately 4,300 feet from the intersection of Texas F.M. 1093 (Westheimer Road) and Dunvale in Harris County. The street address is 3720 Dunvale in Houston, Texas. The site is in Block 3 of Blossom Heights on Lot 20 and the south half of Lot 10. The facility is owned by Metal Coatings Corporation. This location is the drainage area of Buffalo Bayou (North Latitude 29°45'15", West Longitude 95°16'15").

II. Facilities and Operations Authorized

A. The permittee is authorized to store industrial solid wastes generated from plant sources including those listed in the application as described herein. Waste from off-site sources is limited to that generated by permittee-owned facilities. Hazardous wastes are limited to those within the Hazard Code Group indicated below.

1. Hazard Code groups (as prescribed by U.S. Environmental Protection Agency regulations) in effect upon date of permit approval:

	Ignitable (I)		Acute Hazardous Waste (H)
x	Toxic (T)		EP Toxic (E)
	Corrosive (C)	x	Reactive (R)

2.

Waste Descriptions	TDWR Waste Class	Hazard Code(s)
Waste pickling/ plating solution	I	R,T
Waste rinsing/ phosphating solution	I	R,T

B. The permittee is authorized to operate the following facility component for storage. No processing or disposal is authorized by this permit. All hazardous waste management activities are to be confined to authorized facility units.

1. Tank, above-grade, open-top, steel with a glass flake-filled epoxy liner for storage of 1,875 gallons (maximum capacity) waste plating/pickling solution, and waste rinsing/phosphating solution.

C. Authorization to conduct industrial solid waste operations at this facility is contingent upon maintenance of financial assurance pursuant to Provision IV.A., and is subject to compliance with Provision IV.F.

D. The facility components and operational methods authorized are limited to those describied herein and by the application and related plans and specifications. All facility components and operational methods are subject to the terms and conditions of this permit and TDWR Rules. Prior to constructing or operating any facility component in a manner which differs from the related plans and specifications, the permittee is required to:

1. Notify the TDWR and submit plans and specifications for the proposed modification;

2. Receive written authorization of the Executive Director.

E. Any proposed facility modifications, addition of components, or expansion in capacity which has not been addressed by the terms of this permit must be authorized in accordance with TDWR amendment rules.

III. Facilities Design, Construction and Operation

A. Facility design, construction, and operation must comply with this permit, TDWR Rules, and be in accordance with plans and specifications for design and operation approved by the terms of this permit. All plans and specifications for design and operation submitted with the application are approved subject to the terms of this permit and any other orders of the Texas Water Commission.

B. The entire waste management facility shall be designed, constructed, operated, and maintained to prevent inundation of and discharges from the areas surrounding the facility components.

C. The tank shall be operated and maintained to have sufficient shell strength and pressure controls to assure that it does not rupture or collapse. A minimum shell thickness of 0.25 inches shall be maintained at all times.

D. The permittee shall follow the contingency plan developed in accordance with 40 CFR Part 264 Subpart D which was submitted in the application, and which is hereby approved subject to the terms of this permit and any other orders of the Texas Water Commission. The contingency plan is hereby made a part of this permit as "Attachment A."

E. The permittee shall follow the inspection schedule developed in accordance with 40 CFR 264.15 which was submitted in the application, and which is hereby approved subject to the terms of this permit and any other orders of the Texas Water Commission. The inspection schedule is hereby made a part of this permit as "Attachment B."

F. The entire waste management facility shall be designed, constructed, operated, maintained and managed to prevent inundation of and discharges from the loading and unloading areas and the area surrounding the facility component authorized by Provision II.B., with a drainage control system that collects spills and leaks in such a manner as to:

1. Preclude the release from the system of any collected spills, or leaks, except as provided in Provision III.G. This requirement shall be met by, at a minimum, providing a base and sides which are free of cracks or gaps which are sufficiently impervious to contain leaks and spills until the collected material is detected and removed, and providing curbs or sides designed to withstand a full hydrostatic head; and

2. Prevent run-on into the system from non-storage areas.

G. Collected spills, leaks, and clean-up residues shall be removed promptly after the spillage and shall be removed in as timely a manner as is necessary to prevent overflow of the collection system, by one of the following methods:

1. Removal to an authorized facility component;

2. Removal off-site for processing and/or disposal at an authorized industrial solid waste management facility; or

3. Discharge in accordance with a wastewater discharge permit.

H. All wastes must be conveyed off-site to a facility authorized to receive such waste.

I. All pumps, fire- and spill-control equipment, decontamination equipment, and all other equipment and structures authorized or required by this permit shall be maintained in good functional condition.

IV. Closure

A. The permittee shall provide financial assurance in a form acceptable to the Executive Director of the TDWR in an amount not less than $3300.00. Financial assurance shall be secured and maintained in compliance with Department regulations on hazardous waste financial requirements (31 TAC 335.452 and 40 CFR 264 Subpart H).

B. The permittee shall submit to the Executive Director upon request such information as may be necessary to determine the adequacy of financial assurance.

C. Facility closure shall commence:

1. Upon direction of the Texas Water Commission or the Executive Director for violation of the permit, TDWR Rules, State Statues; or

2. Upon suspension, cancellation or revocation of the terms and conditions of this permit concerning the authorization to receive and store waste materials; or

3. Upon abandonment of the site; or

4. Upon direction of the Executive Director for failure to secure and maintain an adequate bond or other financial assurance as required in Provision IV.A.; or

5. When necessary to comply with Provision IV.D.

D. Facility closure shall be completed in accordance with the requirements of 31 TAC Section 335.452, and 40 CFR Part 264, Subpart G and the closure plan submitted with the application, which is hereby approved subject to the terms of this permit and any other orders of the Texas Water Commission. The closure plan is hereby made a part of this permit as "Attachment C."

E. Upon completion of closure, the permittee must submit to the Executive Director certification by an independent registered professional engineer that the facility has been closed in accordance with the approved closure plan.

F. Within 30 days following final approval of the permit, the permittee must furnish to the Executive Director:

1. A copy of the financial assurance mechanism adopted in compliance with Title 40 of the Code of Federal Regulations (CFR) Part 264.143; and

2. A copy of the insurance policy or other documentation which comprises compliance with the requirements of 40 CFR Part 264.147.

V. Standard Permit Conditions

A. The permittee has a duty to comply with all conditions of this permit. Failure to comply with any permit condition constitutes a violation of the permit and the Texas Water Code or the Texas Solid Waste Disposal Act, and is grounds for enforcement action, for permit amendment, revocation or suspension, or for denial of a permit renewal application.

B. In order to continue a permitted activity after the expiration date of the permit, the permittee must apply for a new permit or renewal. Authorization to continue such activity will terminate upon the effective denial of said application.

C. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of the permit.

D. The permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit.

E. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit.

F. The permittee shall furnish to the Executive Director, within a reasonable time, any relevant information which the Executive Director may request to determine whether cause exists for amending, revoking, suspending, or terminating the permit. The permittee shall also furnish to the Executive Director, upon request, copies of records required to be kept by this permit.

G. The permittee shall give notice to the Executive Director prior to physical alterations or additions to the permitted facility if such alterations or additions would require a permit amendment or result in a violation of permit requirements.

H. Written approval from the Executive Director is required before beginning any change in the permitted facility or activity that would result in noncompliance with other permit requirements.

I. Unless specified otherwise, the permittee shall report any noncompliance which may endanger health or the environment. Report of such information shall be provided orally within 24 hours from the time the permittee becomes aware of the noncompliance. A written submission of such information shall also be provided within 5 working days of the time the permittee becomes aware of the noncompliance. The written submission shall contain a description of the noncompliance and its cause; the potential danger to human health or the environment; the period of noncompliance, including exact dates and times; if the noncompliance has not been corrected, the anticipated time it is expected to continue; and, steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

J. Inspection and entry shall be allowed as prescribed in Texas Water Code, Chapter 26 and Chapter 27, and Section 7 of the Solid Waste Disposal Act, as applicable.

K. 1. Monitoring samples and measurements shall be representative of the monitored activity.

   2. Monitoring and reporting records, including strip charts and records of calibration and maintenance, shall be retained for a period of three (3) years from the date of the record or report. This period may be extended by request of the Executive Director.

   3. Records of monitoring activities shall include the following:

      a. date, time and place of sample or measurement;

      b. individual who collected the sample or made the measurement;

c. date of analysis;

d. the individual who made the analysis;

e. the technique or method of analysis; and,

f. the results of the analysis.

L. Any noncompliance other than that specified above, or any required information not submitted or submitted incorrectly, shall be reported to the Executive Director as promptly as possible.

M. This permit may be transferred only according to the provisions of 31 TAC Section 341.235 (relating to Transfer of Permits) and 31 TAC Section 341.270 (relating to Action on Application for Transfers).

N. All reports and other information requested by the Executive Director shall be signed by the person and in the manner required by 31 TAC Section 341.317 relating to Signatories to Reports.

O. This permit may be amended, suspended and reissued, or revoked for cause. The filing of a request by the permittee for a permit amendment, suspension and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

P. This permit does not convey any property rights of any sort, or any exclusive privilege.

Q. Monitoring results shall be provided at the intervals specified elsewhere in this permit.

R. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

S. Where the permittee becomes aware that it failed to submit any relevant facts in a permit application or submitted incorrect information in an application or in any report to the Executive Director, it shall promptly submit such facts or information.

T. The permittee need not comply with the conditions of this permit to the extent and for the duration such noncompliance is authorized in an emergency order issued by the Commission.

U. For a new facility, the permittee shall not commence storage, processing or disposal of solid waste; and for a facility being modified, the permittee shall not process, store or dispose of solid waste in the modified portion of the facility, until:

1. The permittee has notified the local TDWR District Office and submitted to the Executive Director by certified mail or hand delivery a certification prepared and sealed by a professional engineer with current registration pursuant to the Texas Engineering Practice Act, and signed by the permittee. Required certification shall be in the following form:

   This is to certify that construction of the following facility components authorized or required by TDWR Permit No. HW-50017-000 has been completed, and that construction of said facilities has been performed in accordance with and in compliance with the design and construction specifications of permit No. HW-50017-000:

   (Description of facility components with reference to applicable permit provisions), and

2. The Executive Director has inspected the modified or newly constructed facility and finds it is in compliance with the conditions of the permit; or within 15 days of submission of the letter required by Provision V.U.1., the permittee has not received notice from the Executive Director of an intent to inspect, prior inspection is waived and the permittee may commence processing, storage or disposal of solid waste.

V. The following shall be included as information which must be reported orally within 24 hours pursuant to Provision V.I.:

1. Information concerning release of any solid waste that may cause an endangerment to public drinking water supplies.

2. Any information of a release or discharge of solid waste, or of a fire or explosion from a facility, which could threaten the environment or human health outside the facility. The description of the occurrence and its cause shall include:

   a. name, address, and telephone number of the owner or operator;

   b. name, address, and telephone number of the facility;

   c. date, time and type of incident;

   d. name and quantity of material(s) involved;

   e. the extent of injuries, if any;

   f. an assessment of actual or potential hazards to the environment and human health outside the facility, where this is applicable; and

   g. estimated quantity and disposition of recovered material that resulted from the incident.

W. The Executive Director may waive the five-day written notice requirement as specified in Provision V.I. in favor of a written report submitted to the Department within 15 days of the time the permittee becomes aware of the noncompliance or condition.

X. An annual report must be submitted covering facility activities during the previous calendar year.

Y. Emissions from this facility must not cause or contribute to a condition of "air pollution" as defined in Section 1.03 of the Texas Clean Air Act or violate Section 4.01 of the Texas Clean Air Act, Article 4477-5, V.A.T.S. If the Executive Director of the Texas Air Control Board determines that such a condition or violation occurs, the permittee shall implement additional abatement measures as necessary to control or prevent the condition or violation.

VI. Incorporated Regulatory Requirements

A. The following Texas Department of Water Resources regulations are hereby made provisions and conditions of this permit:

1. 31 TAC Section 335.453;

2. 31 TAC Section 335.454; and

3. 31 TAC Section 335.455.

B. To the extent applicable to the activities authorized by this permit, the following provisions of 40 CFR Part 264, adopted by reference at 31 TAC Section 335.452, are hereby made provisions and conditions of this permit, except as otherwise provided in 31 TAC Sections 335.12, 335.15, and 335.453-335.455, and to the extent consistent with the Solid Waste Disposal Act, Article 4477-7, Revised Civil Statutes, and the Rules of the Texas Water Development Board:

1. Subpart B -- General Facility Standards;

2. Subpart C -- Preparedness and Prevention;

3. Subpart D -- Contingency Plan and Emergency Procedures;

4. Subpart E -- Manifest System, Recordkeeping, and Reporting;

5. Subpart G -- Closure and Post - Closure;

6. Subpart H -- Financial Requirements;

7. Subpart J -- Tanks.

ATTACHMENT A

CONTINGENCY PLAN

METAL COATINGS CORP.
Houston, Texas Facility

TABLE OF CONTENTS

C. CONTINGENCY PLAN

1. Indicate the equipment, devices, and methods used at the facility.

   a. Internal communication or alarm system:

   X voice

   ___ signal

   ___ public address

   ___ portable microphone

   ___ other (specify) ___

   b. External communication systems:

   X telephone

   ___ hand-held two-way radio

   ___ other (specify) ___

   c. Emergency Control Equipment such as:

   X fire control equipment (using foam, inert gas or dry chemicals)

   ___ spill control equipment

   ___ decontamination equipment

   ___ other (specify) Secondary containment around tanks

   d. Water at adequate pressure and volume to supply:

   ___ water hose streams

   ___ foam producing equipment

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___ automatic sprinklers

___ water spray system

___ other (specify) ____________________

X NOT required (state why) Waste is non-ignitable aqueous liquid

2. If provided, do all personnel involved in the operation have immediate access to an internal alarm or emergency communication device?

___ YES ___ NO X NOT APPLICABLE

Describe briefly ____________________

3. The following parties were familiarized with the facility operations and layout, hazardous waste properties, evacuation route, etc., as appropriate:

Police: Houston Police Department

Address: 4503 Beechnut

Person Contacted: --- Phone No.: 666-8806

Agreed Arrangements: Police Department will be informed that a non-flammable, potentially toxic aqueous liquid is stored outside the building.

Fire: Houston Fire Department

Address: ----

Person Contacted: ---- Phone No.: 227-2323

Agreed Arrangements: Fire Department will be informed that a non-flammable, potentially toxic aqueous liquid is stored outside the building.

Hospital: Rosewood Generaly Hospital

Address: 9200 Westheimer Road

Person Contacted: ---- Phone No.: 780-7900

Agreed Arrangements: Rosewood Hospital will be informed that a non-flammable, potentially toxic aqueous liquid is stored outside the building.

Other:

Address:

Person Contacted: Phone No.:

Agreed Arrangements:

4. Emergency Coordinators (list all individuals or positions qualified to act in this position in order or priority).

Name, Title: Ron Avery, Plant Manager

Address: P. O. Box 36407, Houston, Texas 77036

Home Phone No.: [redacted] Office Phone No.: (713) 977-0123

Name, Title:

Address:

Home Phone No.: Office Phone No.:

Name, Title:

Address:

Home Phone No.: Office Phone No.:

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5. List all types of emergency equipment at the facility and include the location and a physical description of each item and a brief outline of its capabilities.

Emergency Equipment Types	Location and Physical Description	Outline of Capabilities
Fire Extinguishers	Hand held foam and chemical, located throughout the building	Portable
Face Shields/Goggles	Available for all personnel	Acid Resistant
Rubber Gloves	Available for all personnel	Acid Resistant
Absorbent	Inside building adjacent to tanks	Capable of absorbing small spills caused by minor leaks or overtopping to storage tanks.

Permit No. HW-50017
Attachment A
Sheet 5 of 7

6. Evacuation Plan

- Evacuation would not be necessary since the storage tanks are located outside of the areas normally used by employees.

- Should evacuation become necessary, all personnel will exit the building to Dunvale Street.

(attach additional sheets as necessary)

7. Emergency Procedures:

Check the potential emergency situation(s)

___ Fire ___ Gaseous vapor release to atmosphere

___ Explosion _X_ Aqueous release to surface water

Describe the actions to be taken by the emergency coordinator and other personnel in the event of an emergency.

In the event of an accidental release of waste from the storage tanks, the emergency coordinator will:

(1) determine if the spilled liquid has breached the secondary containment;

(2) if not, he will direct employees to apply sorbent materials within the diked area;

(3) if the spill has breached the dike, he will determine if the fluid has reached the stormwater ditch on Dunvale Street. If it has, he will inform the appropriate state and local agencies.

In all cases, the emergency coordinator will direct personnel to repair the source of leak or spill and return any collectable spill residue to secure containment.

All employees are well trained in the handling of the hazardous chemicals potentially contained in the storage tanks, since these are the same materials used in the metal finishing processes. In addition, all employees are provided with the proper safety equipment including gloves, aprons and face shields.

(attach additional sheets as necessary)

B. INSPECTION SCHEDULE (attach additional sheets as necessary)

Facility Component(s) and Basic Elements	Possible Error, Malfunction or Deterioration	Frequency of Inspection
Storage Tank No. 1	Overfill/Level	Daily and during pumping
	Leaks/Material of Construction	Weekly

RECEIVED
JUL 22 1982
PERMIT CONTROL
TDWR

Attachment B

Permit No. HW-50017
Attachment B
Sheet 1 of 1

ATTACHMENT C

IV. CLOSURE AND POST CLOSURE PLANS

A. Closure

1. Will facility components be closed by removing all waste and waste residues?

   X YES, all components closed in this manner

   ___ NO, but some components closed in this manner

   ___ NO, no components closed in this manner

2. State the maximum volume(s) and type(s) of waste "in house" at any time:

   1,875 gallons of waste pickling/plating solution and waste rinsing/phosphating solution.

3. List the facility components to be decontaminated, the method of decontamination, and the volume of waste and waste residues generated:

Facility Component	Method of Decontamination	Volume Generated
Storage tank	Steam clean	1,875 gal. wastes
		235 gal. wash waters

4. Expected year of closure 1995

5. Estimated cost of closure $3,300

REFERENCE 4

TXD 072181969 31596

4 December 1985

TECHNOEQUIP

Wastewater Treatment Technologies & Equipment
4103 Villanova · Houston, Texas 77005 · 713/660-9130

Permits Division
Texas Water Commission
PO Box 13087
Austin, Texas 78711

Re: Changes to Solid Waste Registration
Metal Coatings Corporation - Registration # 31596

We rquest the following changes or additions to the Notice of Registration # 31596 for Metal Coatings Corporation, Houston, Texas:

Change - Contact Person - Mike Roundtree
Change - Phone - 713/977-0123

Section I, Waste generated
Add - Misc trash, pallets, shipping containers 279760 om
Add - Spent filter cartridges, listed Hazardous Waste F008 & F006 979720 om

Section III, On-site waste management facilities
Add - On-site Hazardous Waste Storage, TWC permit # HW-50017-000

If you have any questions concerning this request and/or need additional information, please contact me directly or Mike Roundtree at Metal Coatings.

TechnoEquip

Thomas M Tiller

Thomas M Tiller
Engineering

MCC125R1

REFERENCE 5

CONSENT TO REVOCATION OF

TEXAS WATER COMMISSION PERMIT APR 17 1986

I, MICHAEL ROUNTREE VP, acting on behalf of
(Name & Title)

Metal Coatings Corp., do hereby consent to
(Name of Permittee)

the revocation of Texas Water Commission Permit No. 50017 pursuant to the provisions of 31 TAC Section 341.241(b).

The activities regulated by the permit were:

( ) Never begun

(X) Terminated on or about(Date) 12/84

( ) Diverted to another permitted wastewater treatment system
Please identify facility receiving waste ______________________ and the approximate date the diversion occurred ______________________

I also certify that there are no materials remaining at the permitted site which endanger ground or surface water quality.

M H Rountree
(Signature)

713 977 0123
(Telephone Number)

4/14/86
(Date)

Permits Control & Reports Section
Telephone: (512)475-3318

REFERENCE 6

CENTRAL RECORDS COPY

31596

TEXAS WATER COMMISSION

September 19, 1986

Mr. Mike H. Rountree
Metal Coatings Corp.
P.O. Box 36407
Houston, Texas 77231

Re: Full Facility Closure
Hazardous Waste Permit No. HW-50017-000
ISW Registration No. 31596

Dear Mr. Rountree:

This letter is in response to your notification of closure of a hazardous waste tank, submitted May 29, 1986. Since your closure plan was approved upon issuance of your permit in February 1985, publishing of a notice and approval of your closure plan is not necessary. Your letter of May 29, 1986 has satisfied the notification requirement of 31 TAC 335.6. Therefore, no other action is required on your part prior to closing your hazardous waste tank.

We do request, however, that you verify decontamination of the tank by analyzing a sample of the tank rinse water for total cyanide and comparing the results to that of a similar analysis of the water used for decontamination, prior to rinsing. The results of these analyses should be submitted along with the certifications of closure to this office. Also, please contact the regional office at least ten days in advance of commencing closure activities to allow District personnel the opportunity to observe and split samples if they so desire.

Once closure has been completed, it should be noted that certifications of closure must be submitted by both the owner or operator of the subject facility and in independent Registered Professional Engineer that closure has been completed in accordance with the approved closure plan. Upon acceptance of these certifications by this agency, if you have no other hazardous waste management units subject to permitting at your facility and choose to proceed with permit cancellation, then please complete and return the attached "Consent to Revocation of Texas Water Commission Permit" form.

Any further questions concerning closure and permit withdrawal should be referred to Cesar Farias at AC512/463-8193.

Sincerely,

Kelly L. Meloy

Kelly L. Meloy, Head
Facility Unit I
Hazardous and Solid Waste Permits Section

KLM:af
Attachment
cc: Bill Brown, TWC - Austin
Ray Austin, TWC - Austin
TWC Southeast Region Office - Deer Park

REFERENCE 7

31596 CR

December 17, 1986

TechnoEquip

PO Box 2046
Humble, Texas 77347
713/446-4188

Mr. Minor Hibbs
Permit Division
Texas Water Commission
PO Box 13087
Austin, Texas 78711

Re: Metal Coatings Corporation
Revocation of Hazardous Waste Permit No. HW-50017-000

Mr Hibbs:

This letter is to certify that operation of the hazardous waste storage facility authorized by TWC permit no. HW-50017-000 has ceased and that the facility has been closed in accordance with the provisions of the approved closure plan. Attached are the laboratory analysis of the facility final rinse water and Hazardous Waste Manifest removing the remaining wastes from the facility.

As this is the only facility authorized by the permit, we are requesting the revocation of the permit and have attached a 'Consent to Revocation of Texas Water Commission Permit'.

Should additional information be required for this matter, please contact myself or Mike Roundtree (Metal Coatings, 713/977-0123).

Thomas M. Tiller

Thomas M. Tiller, P.E.

STATE OF TEXAS
THOMAS M. TILLER
59290
REGISTERED PROFESSIONAL ENGINEER

MCC12176
att: lab anal, HW man, con rev
xc: MR/MCC

CONSENT TO REVOCATION OF

TEXAS WATER COMMISSION PERMIT

I, Michael H. Rountree VP, acting on behalf of
(Name & Title)

Metal Coatings Corp, do hereby consent to
(Name of Permittee)

the revocation of Texas Water Commission Permit No. 50017 pursuant to the provisions of 31 TAC Section 341.241(b).

The activities regulated by the permit were:

( ) Never begun

(X) Terminated on or about(Date) Sept 4, 1986

( ) Diverted to another permitted wastewater treatment system
Please identify facility receiving waste ______
______ and the approximate date the diversion occurred ______

I also certify that there are no materials remaining at the permitted site which endanger ground or surface water quality.

MH Rountree
(Signature)

713 977 0123
(Telephone Number)

12/19/86
(Date)

SOUTHERN PETROLEUM LABORATORIES, INC.

Certificate Number 086489
Invoice Number 204458
September 10, 1986

Metal Coatings Corporation
P.O. Box 36407
Houston, Texas 77236

Attention: Mr. Mike Roundtree

Sample Description: Storage Tank Rerinse
Date Received: 09/04/86

			Date	Time	Analyst
Cadmium total EPA storet number 01027	< 0.02	mg/l	09/05/86	8:19 am	GS
Cyanide total EPA storet number 00720	< 0.05	mg/l	09/09/86	11:50 am	APM
pH EPA storet number 00403	7.77		09/08/86	2:30 pm	APM
Zinc total EPA storet number 01092	< 0.05	mg/l	09/05/86	8:38 am	GS

Quality Assurance: These analyses are performed in accordance with EPA guidelines for quality assurance. These procedures include the following as a minimum requirement: comparisons against known standards in each run, one in ten sample splits, and a quarterly method review against known spike samples.

SOUTHERN PETROLEUM LABORATORIES, INC.

J. C. Whatley

TEXAS WATER COMMISSION
P.O. Box 13087, Capitol Station
Austin, Texas 78711-3087

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form approved. OMB No. 2000-0404. Expires 7-31-86

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: TXD072181969
Manifest Document No.:
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
METAL COATINGS CORP.
P.O. BOX 36407
HOUSTON, TEXAS 77236

4. Generator's Phone (713)9770123

A. State Manifest Document Number: 00231553
B. State Generator's ID: 31596

5. Transporter 1 Company Name: ALSTATE VACUUM & TANKS,INC.
6. US EPA ID Number: TXD 010812030
C. State Transporter's ID: 40008
D. Transporter's Phone: (713)4821223

7. Transporter 2 Company Name:
8. US EPA ID Number:
E. State Transporter's ID:
F. Transporter's Phone:

9. Designated Facility Name and Site Address
EMPAK, INC.
2759 BATTLEGROUND RD.
DEER PARK, TEXAS 77536

10. US EPA ID Number: TXD 097673149
G. State Facility's ID: DW157
H. Facility's Phone: (713)4791990

11A. HM	11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
	a. HAZARDOUS WASTE SOLID OR LIQUID, NOS ORM-E NA9189	1	DM	262	P	942720
	b.					
	c.					
	d.					

J. Additional Descriptions for Materials Listed Above
.13

K. Handling Codes for Wastes Listed Above
D80

15. Special Handling Instructions and Additional Information

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.
Unless I am a small quantity generator who has been exempted by statute or regulation from the duty to make a waste minimization certification under Section 3002(b) of RCRA, I also certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and I have selected the method of processing, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment.

Printed/Typed Name: MICHAEL H. ROUNTREE
Signature: Michael H Rountree
Month Day Year: 12 10 86

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Allstate Vac & Tanks
Signature: Joe Monroe
Date Month Day Year: 12 10 86

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature:
Date Month Day Year:

19. Discrepancy Indication Space
EMPAK, INC.
2759 BATTLEGROUND RD.
DEER PARK, TEXAS 77536
VOLUME SUBJECT TO FINAL VERIFICATION

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Geronimo Martinez
Signature: Geronimo M
Date Month Day Year: 12 11 86

EPA Form 8700-22 (Rev. 4-85) Previous edition is obsolete. White - original Pink-TSD Facility Yellow-Transporter Green-Generator's first copy
TWC-0311 (Rev. 09-01-85)

REFERENCE 8

TEXAS WATER COMMISSION

January 6, 1987

Mr. Michael H. Rountree
Vice President
Metal Coatings Corporation
P.O. Box 36407
Houston, Texas 77236

Re: Metal Coatings Corporation
Revocation of Hazardous Waste Permit No. HW-50017-000

Dear Mr. Rountree:

This is in response to a letter written to the Texas Water Commission (TWC) on December 17, 1986 by Thomas M. Tiller, P.E. of TechnoEquip requesting revocation of Metal Coatings Corporation's hazardous waste permit, HW 50017-000.

Pursuant to 31 Texas Administrative Code (TAC) 305.67.(b), "If a permittee requests or consents to the revocation or suspension of the permit, the Executive Director may revoke or suspend the permit without the necessity of a public hearing or commission action". Therefore, effective the date of this letter, Hazardous Waste Permit No. HW-50017-000 is hereby revoked. By copy of this letter, I am notifying the Texas Water Commission of this action as set forth in the aforementioned rule.

Questions or comments should be directed to Mr. Rex Coffman of the Reports and Management staff at 512/463-8197.

Sincerely,

Larry R. Soward

Larry R. Soward
Executive Director

cc: The Texas Water Commission
Thomas M. Tiller, P.E., TechnoEquip, P.O. Box 2046, Humble, Texas 77347
Texas Water Commission Southeast Region Office - Deer Park

REFERENCE 9

Sw Reg # 31596

metal COATINGS CORP

RECEIVED
SEPT 29 88
TEXAS WATER COMMISSION

9/28/88

MR. ED HATTON
TEXAS WATER COMMISSION
P.O. BOX 13087
AUSTIN, TEXAS 78711

DEAR MR. HATTON;

PLEASE, AMEND OUR N.O.R. NO.31596 TO REFLECT THE FOLLOWING CHANGES:

1) WE ARE CURRENTLY GENERATING SPENT SOLVENT WASTE THAT INCLUDES MEK, IPA,DMF, TOLUENE, MINERAL SPIRITS, ACETONE, METHYLENE CHLORIDE. THESE SOLVENTS ARE USED IN THE CLEAN-UP OF PAINT SPRAY EQUIPMENT. APPROXIMATELY TEN GALLONS PER MONTH ARE GENERATED. PLEASE, FURNISH US WITH STATE, EPA, AND DOT IDENTIFICATION NUMBERS AND DESCRIPTIONS.

2) WE ARE CURRENTLY GENERATING AN EVAPORATOR SLUDGE FROM ZINC AND CADMIUM PLATING WASTEWATER. THE FEED IS FROM CAUSTIC CLEANER RINSES, SULFURIC AND HCL ACID RINSES, PLATING RINSES, CHROMATING RINSES, AND PHOSPHATING RINSES. AFTER COLLECTION OF THE SLUDGE FROM THE EVAPORATOR IT IS DRIED IN ONE OF OUR PROCESS OVENS AND THEN DRUMMED. PLEASE, FURNISH US WITH STATE, EPA, AND DOT IDENTIFICATION NUMBERS AND DESCRIPTIONS.

3) WE HAVE ADDED A 1600 GALLON EVAPORATOR AND A BATCH WASTE TREATMENT SYSTEM. A SKETCH IS INCLUDED.

YOUR ASSISTANCE IS GREATLY APPRECIATED. IF WE HAVE FAILED TO FURNISH COMPLETE OR NECESSARY INFORMATION, CONTACT ME AT 713 977 0123.

THANK YOU,

Mike Rountree

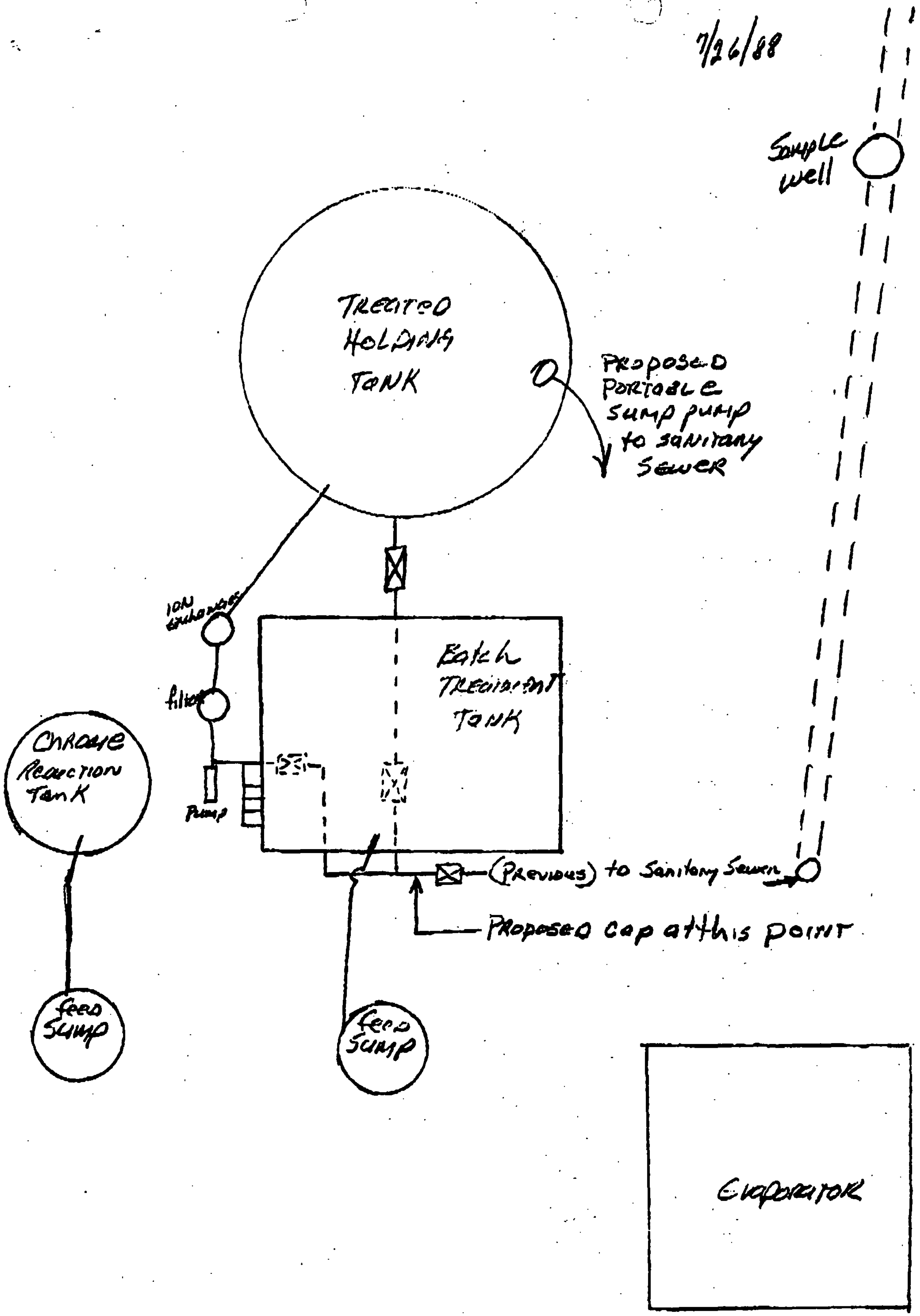
MIKE ROUNTREE

JUN 16 89

cc. STENNIE MEADOURS

P.O. Box 630407 Houston, Texas 77263 (713) 977-0123

7/26/88



Sample well
Treated Holding Tank
Proposed portable sump pump to sanitary sewer
Ion exchanger
filter
Pump
Batch Treatment Tank
Chrome Reduction Tank
(Previous) to Sanitary Sewer
Proposed cap at this point
feed sump
feed sump
Evaporator

REFERENCE 10

31596

metal
COATINGS
CORP

10/4/88

one time
974780
Cadmium bearing waste
VS

GLEN DAVIS
TEXAS WATER COMMISSION
P.O. BOX 13087
AUSTIN, TEXAS 78711

DEAR MR. DAVIS;
WE ARE WORKING WITH STENNIE MEADOURS OF THE DEER PARK OFFICE TO CLEAN UP A SMALL PORTION OF DIRT THAT HAS BEEN CONTAMINATED. SHE SUGGESTED I CONTACT YOU TO REQUEST CLASSIFICATION OF THIS WASTE AS CLASS II.

THE DIRT WAS CONTAMINATED WITH SPENT ACID AND CAUSTIC CLEANER SLUDGES. THE CAUSTIC CLEANER WAS USED TO REMOVE OIL FROM BOLTS AND NUTS PRIOR TO PLATING. THE ACIDS, SULFURIC AND HCL, WERE USED TO PICKLE NUTS AND BOLTS PRIOR TO PLATING.

EVIDENTLY SOME CADMIUM PLATED BOLTS HAD BEEN PICKLED, AS CADMIUM IS PRESENT IN THE CONTAMINATED SOIL. THE CITY OF HOUSTON TESTED THE SOIL AND FOUND ONLY CADMIUM TO BE OUT EP TOXICITY STANDARDS.

PLEASE, CONSIDER THIS FOR CLASS II WASTE. WE AWAIT YOUR RESPONSE TO BEGIN OUR REMOVAL OF THIS SOIL. MY PHONE NUMBER IS 713-977-0123. THANKS, FOR YOUR ASSISSTANCE.

M.H. Rountree

M.H. ROUNTREE
MGR

cc: STENNIE MEADOURS

enclosures: CITY OF HOUSTON TEST REPORTS

6041 /CA ~~VS~~ CR #1

CITY OF HOUSTON
Health and Human Services Department
Bureau of Laboratory Services
1115 North MacGregor • Houston, Texas 770

PHE. Dist. 8

No.- 03484

Date Received: July 15-88 Lab. No.: Sample No.:

Received by: Condition of Seals: Date Sampled: 7-15-88

Sampled by: JS/MP/MR Time Sampled:

Photos: Dye Check: Flow Rate Est. Flow Rate Meas.

Composite Hrs.: Temp. °F °C Field pH Field D. O. mg/l

Field Cl_2 Residual: mg/l

Rainfall within 48 Hrs.: Yes No

Outfall Number: 3

From: Public Health Engineering Bureau, Acct. #100100

Sample Description: Compl #43 - Metal Coating 3700 Dunvale

Remarks: Backyard Soil Surface

Laboratory Analysis: TOTAL METALS

pH holding time exceeded

	Result	Analyst	Date	E.P. TOXICITY	Result	Analyst	Date
1. Ag	mg/l			2a Ag	mg/l		
3. As	7.58 mg/g	Rajan	8-8-88	3a As	0.025 mg/l	Rajan	8-15-8
4. B	mg/l			4a B	mg/l		
5. Cd	510.90 µg/g	K	7/19/88	5a Cd	13.7 mg/l	K	8/2/88
6. Cr	1663.0 µg/g	[illegible]	7/26/88	6a Cr	0.6 mg/l	K	8/2/88
7. Cu	mg/l			7a Cu	mg/l		
8. Hg	mg/l			8a Hg	mg/l		
9. Mn	mg/l			9a Mn	mg/l		
10. Ni	mg/l			10a Ni	mg/l		
11. Pb	204. mg/l	WB	7/24/88	11a Pb	<0.5 mg/l	K	8/2/88
12. Zn	mg/l			12a Zn	mg/l		
13. Se	mg/l			~~13a Se~~ CN	mg/l		

32. Conductivity units

Additional Lab. Information: * These tests were run on a mixture of 4 of soil and 40ml. of deionized water.

Date Reported: Chemistry Lab. Supervisor: W. Baker

Laboratory Analysis:		Analyst	Date
33. Total Coli	/100ml		
34. Fecal Coli	/100ml		

Date Reported: Bacteriological Supervisor:

No.- 03484

CITY OF HOUSTON
Health and Human Services Department
Bureau of Laboratory Services
1115 North MacGregor • Houston, Texas 77030

No.- 03485

PHE. Dist. 8

Date Received July 15 - 88 Lab. No.: Sample No.:

Received by: Condition of Seals: Date Sampled: 7-15-88

Sampled by JS/MP/MR Time Sampled:

Photos: Dye Check: Flow Rate Est. Flow Rate Meas.

Composite Hrs: Temp. °F °C Field pH Field D. O. mg/l

Field Cl_2 Residual. mg/l

Rainfall within 48 Hrs.: Yes No

Outfall Number: 2

From: Public Health Engineering Bureau, Acct. #100100

Sample Description: Compl #43 Metal Coating, 3700 Dunvale

Remarks: Back yard Soil Surface

Laboratory Analysis: TOTAL METALS

		Analyst	Date
pH	holding time exceeded		
1. Ag	mg/l		
As	0.60 ug/g	Rajan	8-8-88
3. B	mg/l		
Cd	226.7 ug/g	K	7/26/88
Cr	37.2 ug/g		7/26/88
7. Cu	mg/l		
8. Hg	mg/l		
9. Mn	mg/l		
10. Ni	mg/l		
11. Pb	17.0 mg/l	WB	7/28/88
12. Zn	mg/l		
13. Se	mg/l		

E.P. TOXICITY

		Analyst	Date
2a Ag	mg/l		
3a As	< 0.005 mg/l	Raj	8-15-88
4a B	mg/l		
5a Cd	9.9 mg/l	K	8/2/88
6a Cr	0.2 mg/l	K	8/2/88
7a Cu	mg/l		
8a Hg	mg/l		
9a Mn	mg/l		
10a Ni	mg/l		
11a Pb	<0.50 mg/l	K	8/2/88
12a Zn	mg/l		
13a Se	mg/l		
~~CN~~			

32. Conductivity umho

Additional Lab. Information: * These tests were run on a mixture of 40 of soil and 40ml. of deionized water.

Date Reported: Chemistry Lab. Supervisor W. Becker

Laboratory Analysis:

		Analyst	Date
33. Total Coliform	/100ml		
34. Fecal Coliform	/100ml		

Date Reported: Bacteriological Supervisor

No.- 03485

City of Houston
Health and Human Services Department
Bureau of Laboratory Services
1115 North MacGregor • Houston, Texas 770[illegible]

PHE. Dist. S

Date Received: July 15-88 Lab. No.: Sample No.: No.- 03486

Received by: Condition of Seals: Date Sampled: 7-15-88

Sampled by: JS/MP/MR Time Sampled:

Photos: Dye Check: Flow Rate Est. Flow Rate Meas.

Composite Hrs: Temp. °F °C Field pH Field D. O. mg/l

Field Cl2 Residual. mg/l

Rainfall within 48 Hrs.: Yes No

Outfall Number: (1)

From: Public Health Engineering Bureau, Acct. #100100

Sample Description: Compl. #43 ~~34~~ Metal Coating - 3700 Dunvale

Remarks: Back yard soil surface

Laboratory Analysis: TOTAL METALS

Test	Result	Unit	Analyst	Date
pH	holding time exceede			
Ag	.	mg/l		
As	18.0	ug/g	Rajan	8-8-88
B	.	mg/l		
Cd	306.55	ug/g	K	7/26/88
Cr	447.0	ug/g	K	7/26/88
Cu	.	mg/l		
Hg	.	mg/l		
Mn	.	mg/l		
Ni	.	mg/l		
Pb	336.	mg/l	WB	July 28'88
Zn	.	mg/l		
Se	.	mg/l		

E.P. TOXICITY

Test	Result	Unit	Analyst	Date
2a Ag	.	mg/l		
3a As	< 0.005	mg/l	Raj	8-15-88
4a B	.	mg/l		
5a Cd	6.65	mg/l	K	8/2/88
6a Cr	0.1	mg/l	K	8/2/88
7a Cu	.	mg/l		
8a Hg	.	mg/l		
9a Mn	.	mg/l		
10a Ni	.	mg/l		
11a Pb	<0.50	mg/l	K	8/2/88
12a Zn	.	mg/l		
13a Se	.	mg/l		
~~CN~~				

32. Conductivity umho

Additional Lab. Information: * These tests were run on a mixture of 40[illegible] of soil and 40ml. of deionized water.

Date Reported: Chemistry Lab. Supervisor: W. Beck

Laboratory Analysis: Analyst Date

33. Total Coliform /100ml

34. Fecal Coliform /100ml

Date Reported: Bacteriological Supervisor:

No.- 03486

REFERENCE 11

Reg# 31596

TEXAS WATER COMMISSION

November 23, 1988

M. H. Rountree
Metal Coatings Corporation
Post Office Box 630407
Houston, Texas 77263

Re: Solid Waste Registration Number 31596

Dear Mr. Rountree:

This is in response to your letter of September, 1988 letter to Mr. Glen Davis of the Texas Water Commission (TWC) and your letter of August 28, 1988 to the TWC.

In the September 4, 1988 letter you requested a Class II classification for a soil contaminated with spent acid and caustic cleaner sludges. The EP toxicity results submitted showed a leachable cadmium concentration of 13.7 parts per million (ppm) 9.9 ppm and 6.65 ppm. The maximum concentration of cadmium for the characteristic for EP toxicity, as established by the Environmental Protection Agency (EPA), is 1 ppm. Wastes, such as the described contaminated soil, which leach constituents above the maximum concentration limits (described in 40 Code of Federal Regulations (CFR) Section 261.24) are considered hazardous wastes. The waste number 974780 (cadmium bearing waste) has been assigned to this waste for this shipment only.

Your letter dated August 28, 1988 has been reviewed. The information submitted was insufficient to allow the TWC to classify your spent solvent waste and evaporator sludge.

Each generator must determine whether or not a waste is defined as a hazardous waste (see enclosed). We realize that the definition of hazardous waste can be quite complicated. We will therefore attempt to provide as much assistance as we can. However, the ultimate determination must be made by the generator of the waste. The TWC staff cannot process any request that does not include a hazardous waste determination.

A hazardous waste determination must address all of the aspects of the definition of hazardous waste. This includes certain waste mixtures and wastes derived from storage, processing, or disposal of certain hazardous wastes as well as wastes listed in Subpart D of 40 CFR Part 261 ("listed" wastes) and wastes exhibiting a characteristic of hazardous waste identified in Subpart C of 40 CFR Part 261.

If a waste is hazardous (listed in Subpart D or meets a characteristic of Subpart C) there will exist a EPA hazardous waste number for the waste. The hazardous waste numbers can be found in the various paragraphs of 40 CFR Part 261 which define hazardous waste characteristics and list descriptions. We encourage each hazardous waste generator to determine the appropriate hazardous waste number and include that number when reporting the generation and management of that waste to the TWC.

Enclosed for your convenience is a copy of the information each generator is required to submit to the TWC (see Generator Notification Requirements 31 Texas Administrative Code Section 335.6) and the EPA booklet and notification of hazardous waste action which contains 40 CFR Part 261 Subparts C and D.

For information concerning Department of Transportation (DOT) identification numbers and descriptions, you may wish to contact the DOT's Houston office at (713) 750-1678. If you have any questions, please contact Vanessa Schiller of the Compliance Assistance Unit at (512) 463-8175.

Sincerely,

E. V. Hatton

E. V. Hatton, Head
Compliance Assistance Unit
Hazardous and Solid Waste Division

VS:bh

Enclosures

cc: Texas Water Commission Southeast Region - Dee Park Office

REFERENCE 12

PANDAK

code of federal regulations

Protection of Environment

40

PARTS 260 TO 299

Revised as of July 1, 1990

(3) It forms potentially explosive mixtures with water.

(4) When mixed with water, it generates toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment.

(5) It is a cyanide or sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment.

(6) It is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement.

(7) It is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.

(8) It is a forbidden explosive as defined in 49 CFR 173.51, or a Class A explosive as defined in 49 CFR 173.53 or a Class B explosive as defined in 49 CFR 173.88.

(b) A solid waste that exhibits the characteristic of reactivity has the EPA Hazardous Waste Number of D003.

[45 FR 33119, May 19, 1980, as amended at 55 FR 22684, June 1, 1990]

§ 261.24 Toxicity characteristic.

(a) A solid waste exhibits the characteristic of toxicity if, using the test methods described in Appendix II or equivalent methods approved by the Administrator under the procedures set forth in §§ 260.20 and 260.21, the extract from a representative sample of the waste contains any of the contaminants listed in Table 1 at the concentration equal to or greater than the respective value given in that Table. Where the waste contains less than 0.5 percent filterable solids, the waste itself, after filtering using the methodology outlined in Appendix II, is considered to be the extract for the purpose of this section.

(b) A solid waste that exhibits the characteristic of toxicity has the EPA Hazardous Waste Number specified in Table I which corresponds to the toxic contaminant causing it to be hazardous.

TABLE 1.—MAXIMUM CONCENTRATION OF CONTAMINANTS FOR THE TOXICITY CHARACTERISTIC

EPA HW No.[1]	Contaminant	CAS No.[2]	Regulatory Level (mg/L)
D004	Arsenic	7440-38-2	5.0
D005	Barium	7440-39-3	100.0
D018	Benzene	71-43-2	0.5
D006	Cadmium	7440-43-9	1.0
D019	Carbon tetrachloride	56-23-5	0.5
D020	Chlordane	57-74-9	0.03
D021	Chlorobenzene	108-90-7	100.0
D022	Chloroform	67-66-3	6.0
D007	Chromium	7440-47-3	5.0
D023	o-Cresol	95-48-7	[4] 200.0
D024	m-Cresol	108-39-4	[4] 200.0
D025	p-Cresol	106-44-5	[4] 200.0
D026	Cresol		[4] 200.0
D016	2,4-D	94-75-7	10.0
D027	1,4-Dichlorobenzene	106-46-7	7.5
D028	1,2-Dichloroethane	107-06-2	0.5
D029	1,1-Dichloroethylene	75-35-4	0.7
D030	2,4-Dinitrotoluene	121-14-2	[3] 0.13
D012	Endrin	72-20-8	0.02
D031	Heptachlor (and its epoxide)	76-44-8	0.008
D032	Hexachlorobenzene	118-74-1	[3] 0.13
D033	Hexachlorobutadiene	87-68-3	0.5
D034	Hexachloroethane	67-72-1	3.0
D008	Lead	7439-92-1	5.0
D013	Lindane	58-89-9	0.4
D009	Mercury	7439-97-6	0.2
D014	Methoxychlor	72-43-5	10.0
D035	Methyl ethyl ketone	78-93-3	200.0
D036	Nitrobenzene	98-95-3	2.0
D037	Pentrachlorophenol	87-86-5	100.0
D038	Pyridine	110-86-1	[3] 5.0
D010	Selenium	7782-49-2	1.0
D011	Silver	7440-22-4	5.0
D039	Tetrachloroethylene	127-18-4	0.7
D015	Toxaphene	8001-35-2	0.5
D040	Trichloroethylene	79-01-6	0.5
D041	2,4,5-Trichlorophenol	95-95-4	400.0
D042	2,4,6-Trichlorophenol	88-06-2	2.0
D017	2,4,5-TP (Silvex)	93-72-1	1.0
D043	Vinyl chloride	75-01-4	.0.2

[1] Hazardous waste number.
[2] Chemical abstracts service number.
[3] Quantitation limit is greater than the calculated regulatory level. The quantitation limit therefore becomes the regulatory level.
[4] If o-, m-, and p-Cresol concentrations cannot be differentiated, the total cresol (D026) concentration is used. The regulatory level of total cresol is 200 mg/l.

[55 FR 11862, Mar. 29, 1990, as amended at 55 FR 22684, June 1, 1990; 55 FR 26987, June 29, 1990]

EFFECTIVE DATE NOTE: At 55 FR 11862, Mar. 29, 1990, § 261.24 was revised, effective September 25, 1990. At 55 FR 26987, June 29, 1990, the entry for "Heptachlor" in Table 1 was corrected, effective September 25, 1990. For the convenience of the user, the superseded text is set forth below:

§ 261.24 Characteristic of EP toxicity.

(a) A solid waste exhibits the characteristic of EP toxicity if, using the test methods described in Appendix II or equivalent methods approved by the Administrator under the procedures set forth in §§ 260.20 and 260.21, the extract from a representative sample of the waste contains any of the contaminants listed in Table I at a concentration equal to or greater than the respective value given in that Table. Where the waste contains less than 0.5 percent filterable solids, the waste itself, after filtering, is considered to be the extract for the purposes of this section.

(b) A solid waste that exhibits the characteristic of EP toxicity, but is not listed as a hazardous waste in Subpart D, has the EPA Hazardous Waste Number specified in Table I which corresponds to the toxic contaminant causing it to be hazardous.

TABLE I—MAXIMUM CONCENTRATION OF CONTAMINANTS FOR CHARACTERISTIC OF EP TOXICITY

EPA hazardous waste number	Contaminant	Maximum concentration (milligrams per liter)
D004	Arsenic	5.0
D005	Barium	100.0
D006	Cadmium	1.0
D007	Chromium	5.0
D008	Lead	5.0
D009	Mercury	0.2
D010	Selenium	1.0
D011	Silver	5.0
D012	Endrin (1,2,3,4,10,10-hexachloro-1,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo, endo-5,8-dimethano-naphthalene.	0.02
D013	Lindane (1,2,3,4,5,6-hexa- chlorocyclohexane, gamma isomer.	0.4
D014	Methoxychlor (1,1,1-Trichloro-2,2-bis [p-methoxyphenyl]ethane).	10 0
D015	Toxaphene ($C_{10}H_{10}Cl_8$, Technical chlorinated camphene, 67–69 percent chlorine).	0.5
D016	2,4-D, (2,4-Dichlorophenoxyacetic acid).	10.0
D017	2,4,5-TP Silvex (2,4,5-Trichlorophenoxypropionic acid).	1.0

Subpart D—Lists of Hazardous Wastes

§ 261.30 General.

(a) A solid waste is a hazardous waste if it is listed in this subpart, unless it has been excluded from th list under §§ 260.20 and 260.22.

(b) The Administrator will indica his basis for listing the classes or typ of wastes listed in this subpart by er ploying one or more of the followi Hazard Codes:

Ignitable Waste	(I)
Corrosive Waste	(C)
Reactive Waste	(R)
Toxicity Characteristic Waste	(E)
Acute Hazardous Waste	(H)
Toxic Waste	(T)

Appendix VII identifies the constitu ent which caused the Administrator t list the waste as a Toxicity Characte istic Waste (E) or Toxic Waste (T) i §§ 261.31 and 261.32.

(c) Each hazardous waste listed i this subpart is assigned an EPA Ha ardous Waste Number which preced the name of the waste. This numb must be used in complying with th notification requirements of Sectio 3010 of the Act and certain recor keeping and reporting requiremen under Parts 262 through 265, 268, an Part 270 of this chapter.

(d) The following hazardous waste listed in § 261.31 or § 261.32 are subje to the exclusion limits for acutely ha ardous wastes established in § 261.5 EPA Hazardous Wastes Nos. FO2(FO21, FO22, FO23, FO26, and FO27.

[45 FR 33119, May 19, 1980, as amended a 48 FR 14294, Apr. 1, 1983; 50 FR 2000, Ja 14, 1985; 51 FR 40636, Nov. 7, 1986; 55 F 11863, Mar. 29, 1990]

EFFECTIVE DATE NOTE: At 55 FR 1186 Mar. 29, 1990, § 261.30 paragraph (b) was re vised, effective September 25, 1990. For th convenience of the user, the superseded tex is set forth below:

§ 261.30 General.

* * * * *

(b) The Administrator will indicate hi basis for listing the classes or types o wastes listed in this Subpart by employin one or more of the following Hazard Code

Ignitable Waste	(I
Corrosive Waste	(C
Reactive Waste	(R
EP Toxic Waste	(E

REFERENCE 13

MEMORANDUM

TO: FILE

FROM: Kevin Jaynes

DATE: February 6, 1992

SUBJ: Summary of On-Site Reconnaissance Inspection. February 4, 1992. Metal Coatings Corporation, Houston, Texas (TXD072181969).

The ICF KE team conducted a tour of the Metal Coatings Corporation (MCC) facility on February 4, 1992. The ICF KE team met with the plant owner Mike Rountree who supplied requested information and conducted the tour of the facility.

ICF KE team leader Kevin Jaynes interviewed Mr. Rountree. The summary of the interview is as follows:

MCCs current status sheet on file with the Texas Water Commission (TWC) dated 5-16-90 was reviewed. Mr. Rountree indicated that all the information is up to date except that the use of filter cartridges had been discontinued several years ago. These cartridges were used to filter the caustic bath solutions for particles 10 to 15 microns in size.

Mr. Rountree indicated that there are currently 26 employees that work in two shifts, on-call 24 hours a day. Operations began at MCC in 1974.

ICF KE personnel then asked Mr. Rountree to explain the contaminated soil situation. Mr. Rountree explained that the soil had to be removed because of high concentrations of cyanide. The soil was classified as F006 wastes. The contaminated soil was excavated and stored in drums. The amount stored in the facility was approximately 4 to 6 cubic yards. Mr. Rountree then explained the process that he undertook to find an acceptor of these wastes. Mr. Rountree contracted Chemical Waste Management, Inc., Carlyss, Louisiana to begin the removal in November 1990. Mr. Rountree then provided the ICF KE team with manifests on previous removals. Chemical Waste Management, Inc. ran profiles on the wastes to be accepted and collected three of the five roll out containers of F006 sludges that had been mixed with the 4 to 6 yards of contaminated soil. The remaining two roll-out containers of waste were considered to have concentrations of cyanide too high to except. Mr. Rountree then contracted Horsehead Resource Development Company, Inc., Rockwood, Tennessee to remove the remaining amount of accumulated F006 sludge wastes and the remaining cadmium contaminated soil in December 1991.

ICF KE personnel questioned Mr. Rountree of the current plant operations and processes involved at MCC. Mr. Rountree indicated that currently Escandell

Associates, Inc. supplies a portable filter press for the de-watering of F006 sludges that are accumulated in the evaporator tank. The filter press is a portable press mounted on a tractor trailer. Horsehead Resources will dispose of the filter cake that is accumulated.

Mr. Rountree indicated that the roll-out containers varied in size but had capacity for 15 to 25 cubic yards of material.

Mr. Rountree indicated that the process of removing the contaminated soil and the continued problem of removing the F006 sludges took approximately three years. Mr. Rountree stated that Escandell Associates, Inc. will continue to provide the filter press service until MCC can purchase one of their own.

Future waste minimization plans include the reduction of hazardous waste disposal to 2 or 3 manifests a year and eventual classification of the wastes to allow for disposal in a Type II landfill.

Mr. Rountree explained the current plant process from a diagram dated 7-26-88. Mr Rountree corrected the diagram indicating that the feed sumps are now dry, the Chromium reduction and the treatment holding tank are no longer in use but are now stored at the facility. MCC does not discharge any wastewaters into the city sewer system.

Mr. Rountree indicated that cadmium plating no longer occurs at the site and was discontinued in 1988. Some zinc plating with additional phosphate salts still is done on-site.

ICF KE personnel questioned Mr. Rountree as to the status of the previously permitted storage tanks that were at one time located behind the building. Mr. Rountree indicated that one of the tanks had been cut up and sold for scrap and the second had been moved inside and now serves as a runoff collection basin for the sumps and containment units in the plating area.

Mr. Rountree stated that currently MCC operates under TWC generator permit No. 31596.

ICF KE personnel asked Mr. Rountree as to the reason for the soil contamination that was reported. Mr. Rountree indicated that the contamination was from a ruptured tank in the plating line in 1984, before containment structures had been implemented. The area of contaminated soil was excavated until testing by the city considered it adequate.

Current processes involve the preparation and coating of nuts and bolts for a Teflon coating. This coating goes by the registered trade name Fluorocoat. The application is sprayed on and then baked. Current spraying operations involve the use of four overspray booths. These booths incorporate metal baffles to collect the overspray. These baffles are periodically baked in the process ovens and the dried paint is collected as an industrial waste and can be disposed in a Type II landfill. Mr. Rountree indicated that future product and waste minimization plans include the implementation of an Electrostatic Reciprocating Disc for the application of the Teflon coatings.

ICF KE personnel and Mr. Rountree began the tour of the facility. In building Area 1 the following items and topics were discussed:

Area 1 is a shipping and receiving area which holds an overspray booth and a curing oven. Some product storage is here which include 55-gallon drums of acetone, MEK and isopropyl alcohol.

Area 2 houses the remaining three overspray booths. This area also houses a 2,000 gallon phosphating solution tank. The phosphate solution is heated to 160 degrees Fahrenheit to develop phosphate crystals on parts to be coated. There is also an 800 gallon caustic soap cleaning tank adjacent to the phosphate solution tank.

ICF KE personnel toured the area where the 2,000 gallon evaporator tank is housed. The tank is housed in an open area in back of the facility and has no engineered containment structures.

Area 3 houses the electroplating lines. Mr. Rountree explained the plating process which involves consecutive washes and emulsions in water, sulfuric acid, hydrochloric acid, cyanide baths and phosphate salt solutions. The plating line area is bermed with a six inch concrete berm additionally the cyanide tank area is separately bermed. The integrity of the berm was poor with evidence of breached integrity and attempts to patch the cracked concrete portions. Rinse waters from the tanks are removed approximately once a week by a diaphragm pump into holding tanks and eventually introduced into the evaporator tank. This area also houses the old cadmium plating line that is no longer used. These tanks are sometimes used as holding tanks for the rinse waters if the evaporator tank is full.

Area 4 houses a grit blast booth and a shed within a shed that is used to store miscellaneous trash and the remaining barrels from the soil contamination collection. The drums remain in this area which have not been triple rinsed as yet, additional soil from regular clean up of the area and dry paint flakes for future disposal.

ICF KE personnel noted upon exiting the site that the nearest residence is less than 20 feet west of the facility. Additionally, site sketches were developed and surface water runoff from the facility was noted.

REFERENCE 14

DW0550

TEXAS WATER COMMISSION
NOTICE OF REGISTRATION
SOLID WASTE MANAGEMENT

05-16-90

THIS IS NOT A PERMIT AND DOES NOT CONSTITUTE AUTHORIZATION OF ANY WASTE MANAGEMENT ACTIVITIES OR FACILITIES LISTED BELOW. REQUIREMENTS FOR SOLID WASTE MANAGEMENT ARE PROVIDED BY TEXAS ADMINISTRATIVE CODE SECTION 335 OF THE RULES OF THE TEXAS WATER COMMISSION (TWC). CHANGES OR ADDITIONS TO WASTE MANAGEMENT METHODS REFERRED TO IN THIS NOTICE REQUIRE WRITTEN NOTIFICATION TO THE TWC.

DATE OF NOTICE: 05-02-90 REGISTRATION DATE: 10-10-79

REGISTRATION NUMBER: 31596 EPA I.D. NUMBER: TXD072181969

THE REGISTRATION NUMBER PROVIDES ACCESS TO STORED INFORMATION PERTAINING TO YOUR OPERATION. PLEASE REFER TO THAT NUMBER IN ANY CORRESPONDENCE.

COMPANY NAME: METAL COATINGS CORPORATION
P O BOX 630407
HOUSTON, TEXAS 77263
GENERATING SITE LOCATION:
3720 DUNVALE, HOUSTON
CONTACT PERSON: MIKE ROUNTREE
PHONE: (713) 977-0123
NUMBER OF EMPLOYEES: LESS THAN 100
TWC DISTRICT: 07

REGISTRATION STATUS: ACTIVE
REGISTRATION TYPE: GENERATOR
HAZARDOUS WASTE STATUS:
GENERATOR

I. WASTE GENERATED:

WASTE NUMBER	DESCRIPTION	CLASS	CODE	DISPOSITION
001	ACID, HEAVY METAL CONTAMINATED	IH	900190	ON-SITE/OFF-SITE
	EPA HAZARDOUS WASTE NOS. (REFER TO 40 CFR PART 261 FOR DESCRIPTIONS):			
002	PHOSPHATIZING SOLUTION (SALTS PHOSPHATE, ACCLRNTS, SRFCTNTS)	IH	901480	ON-SITE/OFF-SITE
	EPA HAZARDOUS WASTE NOS. (REFER TO 40 CFR PART 261 FOR DESCRIPTIONS):			
003	PLANT REFUSE, GENERAL MISC.	II	279760	OFF-SITE

004 FILTER CARTRIDGES IH 979720 ON-SITE/OFF-SITE

EPA HAZARDOUS WASTE NOS. (REFER TO 40 CFR PART 261 FOR DESCRIPTIONS):

II. Shipping/Reporting: Pursuant to Section 335 of the Texas Administrative Code of the rules of the TWC pertaining to Hazardous Waste management, issuance of manifests and annual reporting are required for Off-site Storage/Processing/Disposal of the following wastes listed in Part I. All manifested wastes should be reported on the annual waste summary report and submitted to the TWC by the 25th of each January for the prior calendar year.

001 900190 ACID, HEAVY METAL CONTAMINATED

002 901480 PHOSPHATIZING SOLUTION (SALTS PHOSPHATE, ACCLRNTS, SRFCTNTS)

004 979720 FILTER CARTRIDGES

III. ON-SITE WASTE MANAGEMENT FACILITIES:

FAC NO.	FACILITY	STATUS
01	CONTAINER STORAGE AREA STORAGE OF WASTE NUMBER(S) 004	ACTIVE
02	TANK (SURFACE) STORAGE OF WASTE NUMBER(S) 001, 002 1875 GAL.	ACTIVE
03	TANK (SURFACE) STORAGE 3 INTERCONNECTINGS TANKS CHROME REACTION, TREATED HOLDING & BATCH TREATMENT TANKS	ACTIVE
04	TANK (SURFACE) STORAGE 1600 GAL. STEEL TANK-EVAPORATOR	ACTIVE

UNLESS OTHERWISE STATED ABOVE, FACILITIES ARE LOCATED
AT 3720 DUNVALE, HOUSTON
COUNTY OF HARRIS

IV. RECORDS.

A. FOR PURPOSES OF FILING ANNUAL REPORTS PURSUANT TO TEXAS ADMINISTRATIVE CODE SECTION 335 OF THE RULES OF THE TWC PERTAINING TO INDUSTRIAL SOLID WASTE MANAGEMENT, RECORDS SHOULD BE MAINTAINED FOR STORAGE, PROCESSING AND/OR DISPOSAL OF THE FOLLOWING WASTE(S) LISTED IN PART I:

001 900190 ACID, HEAVY METAL CONTAMINATED

002 901480 PHOSPHATIZING SOLUTION (SALTS PHOSPHATE, ACCLRNTS, SRFCTNTS)

004 979720 FILTER CARTRIDGES

REFERENCE 15

Ph

163646ms

STATE OF LOUISIANA
DEPARTMENT OF ENVIRONMENTAL QUALITY
HAZARDOUS WASTE DIVISION
P.O. BOX 44307
BATON ROUGE, LOUISIANA 70804

PLEASE PRINT OR TYPE (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039. Expires 9-30-91

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. TXD072181969 Manifest Document No. 24577

2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address: Metal Coatings Corp. 3700 Dunvale, Houston, Tx 77063

4. Generator's Phone (713) 977-0123

A. State Manifest Document Number: LAA 3024577

B. State Generator's ID: 31596

5. Transporter 1 Company Name: WPI Trucking Inc

6. US EPA ID Number: TXD050641463

C. State Transporter's ID: 40369

D. Transporter's Phone: (713) 452-1504

7. Transporter 2 Company Name

8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address: Chemical Waste Management Inc. Rt 2, Box 1955 Carlyss, La. 70663

10. US EPA ID Number: LAD000777201

G. State Facility's ID: 20022

H. Facility's Phone: 318-583-2169

Z00W

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. Hazardous Waste Solid, N.O.S., ORM-E, NA9189 (F006) RQ (cadmium & plating Solids J68456	001	CM	00025	Y	F006 D006 TWC 942720
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above

"Bill Tech Services"

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

In case of emergency, contain material and contact Mike Roundtree at 713-977-0123 and CWM Tech. Services at 713-427-4099

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimize the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: M. H. Rountree — Signature: MH Rountree — Month Day Year: 04 10 91

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Raymond E Dillard — Signature: Raymond E Dillard — Month Day Year: 04 10 91

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name — Signature — Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name: Pam Barker — Signature: Pam Barker — Month Day Year: 04 11 91

IF SPILLED IN LOUISIANA CALL THE LOUISIANA HAZMAT UNIT AT 504/925-6595 (DAY OR NIGHT)

GENERATOR — TRANSPORTER — FACILITY

COPY 2

EPA Form 8700-22 k(Rev. 9/88) Previous edition is obsolete.

DEQ FORM HW-3 (R 9/89)

COPY 2: FACILITY TO GENERATOR

(21500)

1564 23 rs

STATE OF LOUISIANA
DEPARTMENT OF ENVIRONMENTAL QUALITY
HAZARDOUS WASTE DIVISION
P.O. BOX 44307
BATON ROUGE, LOUISIANA 70804

PLEASE PRINT OR TYPE (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039. Expires 9-30-91

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: TXD072181969 Manifest Document No.: 24632
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address: Metal Coating Corp. 3700 Dunvale, Houston TX 77063
4. Generator's Phone (713) 977-0123

A. State Manifest Document Number: LA A 3024632
B. State Generator's ID: 31596

5. Transporter 1 Company Name: Sullivan's Trucking
6. US EPA ID Number: OKT400011057B
C. State Transporter's ID: 40058
D. Transporter's Phone: (902) 796-8155

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID
F. Transporter's Phone

9. Designated Facility Name and Site Address: Chemical Waste Management Inc. Rt 2 Box 1955 Carlyss, LA. 70663
10. US EPA ID Number: LAD000777201
G. State Facility's ID: 70022
H. Facility's Phone: (318) 583-2169

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
Liquid approval TG 4/16/91					
a. Hazardous Waste Solid, N.O.S. ORM-E NA9189 (F006) RQ (Cadmium & Plating Solids) J68456	001	CM	00025	Y	F006 D006 TWC 942720
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
"Bill Tech Services So."

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information
In case of emergency, contain material and contact Mike Roundtree (713) 977-0123 and CWM Tech. Services at (713) 427-4099

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.
If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimize the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name	Signature	Month Day Year
M. H. Rountree	M H Rountree	04 11 91

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year
David L. Grady Sr.	David L Grady Sr.	04 11 91

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month Day Year
M. Schantz	M Schantz	04 13 91

GENERATOR / TRANSPORTER / FACILITY

IF SPILLED IN LOUISIANA CALL THE LOUISIANA HAZMAT UNIT AT 504/925-6595 (DAY OR NIGHT)

COPY 2

EPA Form 8700-22 k(Rev. 9/88) Previous edition is obsolete. DEQ FORM HW-3 (R 9/89)

COPY 2: FACILITY TO GENERATOR

STATE OF LOUISIANA
DEPARTMENT OF ENVIRONMENTAL QUALITY
HAZARDOUS WASTE DIVISION
P.O. BOX 82178
BATON ROUGE, LOUISIANA 70884-2178

PDJ (28632)

PBB 180001

PLEASE PRINT OR TYPE (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039. Expires 9-30-92

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. TXD097218196 Manifest Document No. 89590
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address: Metal Coating Corp. 3700 Dunvale Houston, Texas 77063
4. Generator's Phone (713) 977-0123

A. State Manifest Document Number: LAA 3089590
B. State Generator's ID: 31596

5. Transporter 1 Company Name: Chemical Waste Management
6. US EPA ID Number: ILD099202681
C. State Transporter's ID: 40526
D. Transporter's Phone: (713) 427-4099

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID: 6676
F. Transporter's Phone

9. Designated Facility Name and Site Address: Chemical Waste Management Lake Charles Facility RT 2, Box 1955, John Brannon Rd. Carlyss, LA 70663
10. US EPA ID Number: LAD000777201
G. State Facility's ID: Z0022
H. Facility's Phone: (318) 583-2169

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. RQ (Hazardous Waste Solid, NOS) ORM-E, NA9189 CWM AH8866	006	DM	00330	G	D006, F006 9417720
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
(A) Contains Cadmium
Bill Tech Services

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information
IF Spillage occures contact Chemical Waste Mgt at (205) 652-9721
~~Contain material if spilled~~
Driver has 1990 copy of Emergency Response Guide

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.
If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimize the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: M H Rountree
Signature: M H Rountree
Month Day Year: 12/6/91

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: JAMES HILL
Signature: James Hill
Month Day Year: 12/6/91

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: P. Dirtee
Signature: P. Darter
Month Day Year: 12/9/91

IF SPILLED IN LOUISIANA CALL THE LOUISIANA HAZMAT UNIT AT 504/925-6595 (DAY OR NIGHT)

COPY 2

EPA Form 8700-22 k(Rev. 9/88) Previous edition is obsolete.

DEQ FORM HW-3 (R 9/89)

COPY 2: FACILITY TO GENERATOR

ATER COMMISSION
ox 13087, Capitol Station
stin, Texas 78711-3087

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form approved. OMB No. 2050-0039, expires 09-30-91

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator's US EPA ID No. TXD072181969	Manifest Document No. 004K	2. Page 1 of 1	Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Metal Coatings Corp
PO Box 630407
Houston TX 77263-0407

4. Generator's Phone (713) 977 0123

A. State Manifest Document Number 00029054
B. State Generator's ID 31596

5. Transporter 1 Company Name: WPI Trucking INC
6. US EPA ID Number: TXD050641463
C. State Transporter's ID 40369
D. Transporter's Phone 713-452-1304

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID
F. Transporter's Phone

9. Designated Facility Name and Site Address
HorseHead Resource Development Co. INC
Rockwood Tennessee
10. US EPA ID Number: TND982144099
G. State Facility's ID n A
H. Facility's Phone 1-615-354-0955

11A. HM	11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
	a. Hazardous Waste Solid NOS ORM E NA 9189 (F006) RQ (Cadmium & Plating Solids)	001	CM	00007	Y	F006, D006 TWC 942720
	b.					
	c.					
	d.					

J. Additional Descriptions for Materials Listed Above

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information
IN Case of emergency Contain Material & Contact
Mike Rountree 713.977.0123

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations, including applicable state regulations.

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Printed/Typed Name	Signature	Month Day Year
M.H. Rountree	MH Rountree	01 13 92

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year
Omie D. Milam	Omie D. Milum	01 13 92

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year

19. Discrepancy Indication Space Generator - Please use 5 Digit manifest No.
32060

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month Day Year
~~Mona Mind~~ Toni Peddicord	Toni Peddicord	01 16 92

TWC-0311 (Rev. 01/01/89) White - original Pink-TSD Facility Yellow-Transporter Green-Generator's first copy

...TER COMMISSION
...x 13087, Capitol Station
...stin, Texas 78711-3087

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form approved. OMB No. 2050-0039, expires 09-30-91

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: TXD072181969 | Manifest Document No.: [illegible]
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

A. State Manifest Document Number: 00029055

3. Generator's Name and Mailing Address:
Metal Coatings Corp.
PO Box 630407
Houston TX 77263-0407

B. State Generator's ID: 31596

4. Generator's Phone (713) 977 0123

5. Transporter 1 Company Name: WPI Trucking INC
6. US EPA ID Number: TXD050641463

C. State Transporter's ID: 40369
D. Transporter's Phone: 1-800-733-1504

7. Transporter 2 Company Name:
8. US EPA ID Number:

E. State Transporter's ID:
F. Transporter's Phone:

9. Designated Facility Name and Site Address:
Horsehead Resource Development Co. INC.
Rockwood Tennessee
10. US EPA ID Number: TND982144099

G. State Facility's ID: N/A
H. Facility's Phone: 1-615-354-0955

11A. HM	11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
	a. Hazardous Waste Solid NOS ORM-E NA 9189 (F006) RQ (Cadmium & Plating Solids) T68456	001	CM	00007	Y	F006, D006 TWC 942720
	b.					
	c.					
	d.					

J. Additional Descriptions for Materials Listed Above

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information
IN CASE OF EMERGENCY CONTAIN MATERIAL & CONTACT MIKE ROUNTREE 713 977 0123

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations, including applicable state regulations.
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Printed/Typed Name: M.H. Rountree | Signature: [signature] | Month Day Year: 01 13 92

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Joe Fleming | Signature: [signature] | Date Month Day Year: 01 13 91

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name: | Signature: | Date Month Day Year:

19. Discrepancy Indication Space: Generator, please use 5 digit manifest no.
25120

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: ~~Mona Mino~~ Tony Peddicord | Signature: [signature] | Date Month Day Year: 01 16 92

TWC-0311 (Rev. 01/01/89) White - original Pink-TSD Facility Yellow-Transporter Green-Generator's first copy

TEXAS WATER COMMISSION
P.O. Box 13087, Capitol Station
Austin, Texas 78711-3087

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

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UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: TXD071819969 | Manifest Document No. | 2. Page 1 of: 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address: Metal Coatings Corp, PO Box 630407, Houston Texas 77263

4. Generator's Phone (713) 9770123

A. State Manifest Document Number: 00038547

B. State Generator's ID

5. Transporter 1 Company Name: WPI Trucking INC | 6. US EPA ID Number: TXD050641463

C. State Transporter's ID

D. Transporter's Phone

7. Transporter 2 Company Name | 8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address: Household Resource Development Co INC, Rockwood TN | 10. US EPA ID Number: TND982144099

G. State Facility's ID

H. Facility's Phone

11A. HM	11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
	a. Hazardous waste solid NOS ORM E NA 9189 (F006) 768456	001	CM	00016	Y	
	b.					
	c.					
	d.					

J. Additional Descriptions for Materials Listed Above

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations, including applicable state regulations.

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Printed/Typed Name	Signature	Month Day Year
MH Rountree	MH Rountree	01 30 92

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date Month Day Year
DARRELL BLACK	Darrell Black	01 30 92

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Date Month Day Year

GENERATOR / TRANSPORTER / FACILITY

TEXAS WATER COMMISSION
P.O. Box 13087, Capitol Station
Austin, Texas 78711-3087

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form approved. OMB No. 2050-0039, expires 09-30-91

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: TXD072181969 — Manifest Document No.: 29053

2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

A. State Manifest Document Number: 00029053

3. Generator's Name and Mailing Address: Metal Coatings Corp. PO BOX 630407 Houston TX 77263

4. Generator's Phone (713) 577 0123

B. State Generator's ID: 31596

5. Transporter 1 Company Name: WPI Trucking Inc

6. US EPA ID Number: TXD050641463

C. State Transporter's ID: 40369

D. Transporter's Phone: 1 800 733 1504

7. Transporter 2 Company Name

8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address: Horsehead Resource Development Inc, Rockwood TN

10. US EPA ID Number: TND982144099

G. State Facility's ID

H. Facility's Phone: 1 615 354 0955

11A. HM	11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
	a. Hazardous waste solid NOS ORM E NA 9189 (F006) 768156	001	CM	14	Y	F006 TWC542210
	b.					
	c.					
	d.					

J. Additional Descriptions for Materials Listed Above

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations, including applicable state regulations.
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Printed/Typed Name: M H Rountree — Signature: M H Rountree — Month Day Year: 02 02 92

17. Transporter 1 Acknowledgement of Receipt of Materials — Date

Printed/Typed Name: DARRELL BLACK — Signature: Darrell Black — Month Day Year: 02 02 92

18. Transporter 2 Acknowledgement of Receipt of Materials — Date

Printed/Typed Name — Signature — Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19. — Date

Printed/Typed Name — Signature — Month Day Year

GENERATOR / TRANSPORTER / FACILITY

TWC-0311 (Rev. 01/01/89) White - original Pink-TSD Facility Yellow-Transporter Green-Generator's first copy

REFERENCE 16

Report 289

DIGITAL MODELS FOR SIMULATION OF GROUND-WATER HYDROLOGY OF THE CHICOT AND EVANGELINE AQUIFERS ALONG THE GULF COAST OF TEXAS

TEXAS DEPARTMENT OF WATER RESOURCES

May 1985

TEXAS DEPARTMENT OF WATER RESOURCES

REPORT 289

DIGITAL MODELS FOR SIMULATION OF GROUND-WATER HYDROLOGY OF THE CHICOT AND EVANGELINE AQUIFERS ALONG THE GULF COAST OF TEXAS

By

Jerry E. Carr, Walter R. Meyer,
William M. Sandeen, and Ivy R. McLane
U.S. Geological Survey

This report was prepared by the U.S. Geological Survey
under cooperative agreement with the
Texas Department of Water Resources

May 1985

DIGITAL MODELS FOR SIMULATION OF GROUND-WATER HYDROLOGY OF THE CHICOT AND EVANGELINE AQUIFERS ALONG THE GULF COAST OF TEXAS

By

Jerry E. Carr, Walter R. Meyer,
William M. Sandeen, and Ivy R. McLane
U.S. Geological Survey

INTRODUCTION

Purpose and Scope of This Report

The freshwater aquifers along the Texas Gulf Coast (Figure 1) supply large quantities of water for municipal supply, industrial use, and irrigation. However, extensive development of these aquifers has resulted in large declines of water levels in wells, land-surface subsidence, and saltwater encroachment. The purpose of this study, conducted by the U.S. Geological Survey in cooperation with the Texas Department of Water Resources, was to develop a means for predicting declines in the altitudes of the potentiometric surfaces in the Chicot and Evangeline aquifers for various conditions of pumping. Because of the complexity of the hydrologic system, digital-computer models were used to simulate the declines that would result from given pumping stresses. This report discusses the hydrologic data needed to construct and calibrate the models. It also presents maps showing the observed and simulated declines in the altitudes of the potentiometric surfaces and the observed and simulated subsidence of the land surface.

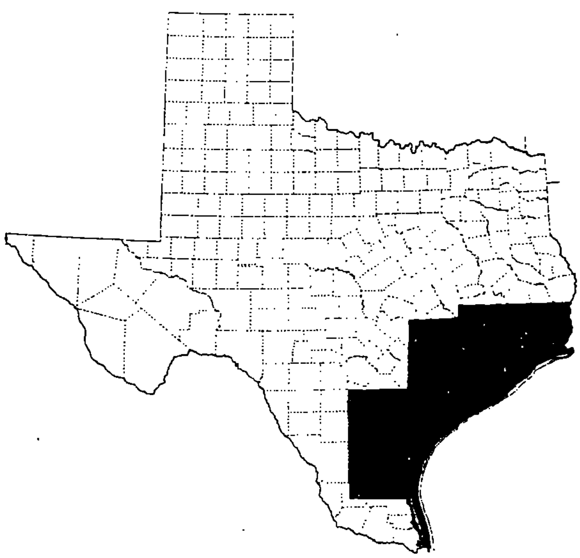


Figure 1.—Location and Extent of the Study Area

The Texas Department of Water Resources makes copies of the model and documentation available through the Texas Natural Resources Information System. Please contact the Texas Natural Resources Information System, P.O. Box 13087, Austin, Texas 78711, telephone 1-(512)-475-3321.

The study area was divided into four subregions—eastern, Houston, central, and southern. A digital-computer model was constructed and calibrated for each subregion. The coastal area was arbitrarily divided into a northern and southern region for presentation of the maps within the report. These maps show the approximate altitude of the base of the Chicot and Evangeline aquifers, the estimated transmissivities and storage coefficients of the aquifers, and the thickness of the clay beds. The modeling procedure consisted of selecting an existing computer program and modifying it to conceptually represent the hydrologic system. For each of the subregions, a generalized model (minimodel) was constructed and calibrated before constructing and calibrating a detailed model (maximodel).

For the purposes of this report, only a brief discussion of the hydrogeology is presented. For additional information on the hydrogeology of the coastal area and on the hydrologic problems related to the withdrawals of ground water, the reader is referred to the reports listed in the section "Selected References."

History of Hydrologic Modeling Along the Texas Gulf Coast

Previous hydrologic modeling along the Texas Gulf Coast was conducted for the Houston area, where the greatest amount of ground-water pumping and corresponding water-level declines have occurred. The first hydrologic model (Wood and Gabrysch, 1965) was an electric-analog model that included about 5,000 square miles (12,950 km^2) in Harris, Galveston, Brazoria, Fort Bend, Austin, Waller, Montgomery, Liberty, and Chambers Counties. This model, which was constructed on the basis of data collected since 1931, was used primarily to predict water-level declines under various conditions of pumping. This first attempt to model the ground-water system was reasonably successful, but the usefulness of the model was limited because the simulations required that the aquifers be operated independently and the results of pumping in the western part of the area could not be simulated.

The second model (Jorgensen, 1975) was an electric-analog model that incorporated additional hydrologic data and reflected more advanced concepts of the hydrologic system. These concepts included consideration of the vertical movement of water between the aquifers and the allowance for water to be derived from the clay beds. This model expanded the area of the first model to about 9,100 square miles (23,570 km^2) to minimize the boundary effects caused by long-term pumping. Jorgensen (1975) noted that additional hydrologic data and modification of the model would be needed for studies of such problems as saltwater encroachment and land-surface subsidence.

The third model (Meyer and Carr, 1979) was a digital-computer model, representing an area of 27,000 square miles (69,930 km^2), that provided an easier means of varying hydrologic properties during the calibration process. This model also was used primarily to predict water-level declines under various conditions of pumping. In general, each of the models was designed to simulate the effects of steady withdrawals of water from well fields for 1 year or longer.

Metric Conversions

Metric equivalents of "inch-pound" units of measurement are given in parentheses in the text. The "inch-pound" units may be converted to metric units by the following conversion factors:

From	Multipy by	To obtain
foot	0.3048	meter (m)
foot $^{-1}$	3.2802	meter $^{-1}$ (m^{-1})
foot per day (ft/d)	0.3048	meter per day (m/d)
foot squared per day (ft^2/d)	0.0929	meter squared per day (m^2/d)
inch per year (in/yr)	2.54	centimeter per year (cm/yr)
mile	1.609	kilometer (km)
million gallons per day	0.04381	cubic meter per seconc
square mile	2.590	square kilometer (km^2)

National Geodetic Vertical Datum of 1929 (NGVD of 1929): A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "mean sea level."

HYDROGEOLOGY OF THE TEXAS GULF COAST

The hydrogeologic units are the Chicot aquifer, Evangeline aquifer, and the Burkeville confining layer (Figures 2 and 3). These units are composed of sedimentary deposits of gravel, sand, silt, and clay. The geologic formations, from oldest to youngest, are: the Fleming Formation and Oakville Sandstone of Miocene age; the Goliad Sand of Pliocene age; the Willis Sand, Bentley Formation, Montgomery Formation, and Beaumont Clay of Pleistocene age; and alluvium of Quaternary age. The relationship between the hydrogeologic units and the geologic formations (stratigraphic units) is given in Table 1. With exception of the alluvium and the Goliad Sand, the formations crop out in belts that are nearly parallel to the shoreline of the Gulf of Mexico. The Goliad Sand is overlapped by younger formations east of the Brazos River and is not exposed at the surface in the coastal area. The younger formations crop out nearer the Gulf and the older ones farther inland. All formations thicken downdip towards the Gulf of Mexico so that the older formations dip more steeply than the younger ones. Locally, the occurrence of salt domes, faults, and folds may cause reversals of the regional dip and thickening or thinning of the formations.

REFERENCE 17

GROUND-WATER WITHDRAWALS AND CHANGES IN GROUND-WATER LEVELS, GROUND-WATER QUALITY, AND LAND-SURFACE SUBSIDENCE IN THE HOUSTON DISTRICT, TEXAS, 1980-84

U.S. GEOLOGICAL SURVEY
Water-Resources Investigations Report 87-4153

Prepared in cooperation with the
CITY OF HOUSTON and the
HARRIS-GALVESTON COASTAL SUBSIDENCE DISTRICT

CONTENTS

CONTENTS

ILLUSTRATIONS

TABLES

METRIC CONVERSIONS

Factors for converting inch-pound units to metric (International System) units are given in the following table:

Multiply inch-pound unit	By	To obtain metric units
acre	0.4047	hectare
acre-foot	0.001233	cubic hectometer
acre-foot per acre	0.003048	cubic hectometer per hectare
foot (ft)	0.3048	meter
foot per day (ft/d)	0.3048	meter per day
foot per year (ft/yr)	0.3048	meter per year
gallon per minute (gal/min)	0.06308	liter per second
inch (in.)	25.40	millimeter
mile (mi)	1.609	kilometer
million gallons per day (Mgal/d)	0.04381	cubic meter per second

National Geodetic Vertical Datum of 1929 (NGVD of 1929): A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "mean sea level."

INTRODUCTION

The purpose of this report is to provide information about ground-water withdrawals, changes in ground-water levels, ground-water quality, and trends in land-surface subsidence in the Houston district during 1980-84. Some data collected prior to 1980 and during the early spring of 1985 are presented to establish long-term trends and relations.

The Houston district, as described in this report, includes all of Galveston County and parts of Brazoria, Chambers, Fort Bend, Harris, Liberty, and Waller Counties (fig. 1). Many homeowners, well drillers, industrial-plant managers, and State and municipal officials provided information for this report. Financial support was provided by the city of Houston and the Harris-Galveston Coastal Subsidence District in a cooperative agreement with the U.S. Geological Survey.

GEOHYDROLOGY OF THE STUDY AREA

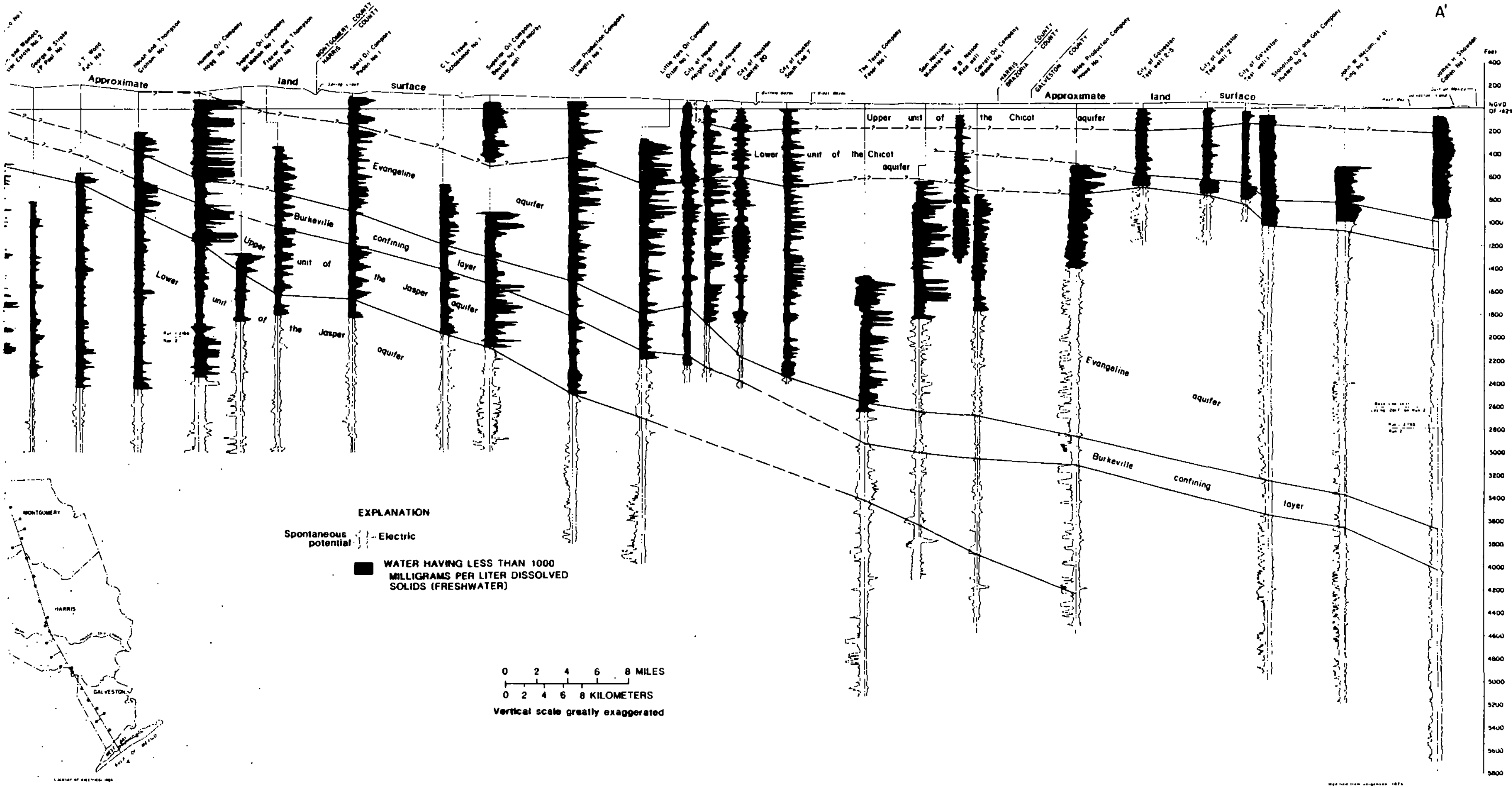
The geohydrologic units discussed in this report primarily are the Chicot and Evangeline aquifers. The Jasper aquifer also underlies the Houston district, but contains water of poor quality except in the northern part of the district. Only two wells presently are known to yield water from the Jasper aquifer in Harris County. These aquifers are composed of sedimentary deposits in the Coastal Plain physiographic province. The province is a broad plain underlain by a southeasterly thickening wedge of layered beds of clay, silt, sand, and gravel. The geologic formations in the study area are, from oldest to youngest: The Oakville Sandstone and Fleming Formation of Miocene age; the Goliad Sand of Pliocene age; the Willis Sand, Bentley Formation, Montgomery Formation, and Beaumont Formation of Pleistocene age; and alluvium of Quaternary age. The relation among the geohydrologic units and the geologic formations is given in table 1. A generalized geohydrologic section of the Chicot, Evangeline, and Jasper aquifers through Montgomery, Harris, Brazoria, and Galveston Counties is shown in figure 2.

Chicot Aquifer

The Chicot aquifer includes all deposits from the land surface to the top of the Evangeline aquifer. The Chicot aquifer is composed of the Willis Sand, Bentley Formation, Montgomery Formation, Beaumont Formation, and Quaternary alluvium. The altitude of the base of the Chicot aquifer is shown in figure 3. The discontinuous sand and clay layers of the Chicot aquifer in some parts of the study area are separated into an upper and lower unit (Jorgensen, 1975, p. 10). When the upper unit of the Chicot aquifer cannot be defined, the aquifer is undifferentiated. The Chicot aquifer is under confined conditions except in the northern part of the district. Generally, in southeastern Harris County and most of Galveston County, the Chicot aquifer contains a thick sand section that has a relatively large (as much as 75 ft/d) hydraulic conductivity (Jorgensen, 1975, p. 15). This sand unit has been intensely pumped and is known locally as the Alta Loma Sand (Alta Loma Sand of Rose, 1943). In this area, there also is another sand unit within the Chicot aquifer referred to as the middle Chicot aquifer. The Chicot aquifer is the main source of ground water in Galveston and southern Harris Counties.

Table 1.--Relations among geohydrologic units and geologic formations

<table>
<tr><th colspan="3">Geologic classification</th><th colspan="6">Geohydrologic unit</th></tr>
<tr><th>System</th><th>Series</th><th>Stratigraphic unit</th><th colspan="2">Houston district (Lang, Winslow, and White, 1950)</th><th colspan="2">Houston district (Jorgensen, 1975)</th><th colspan="2">This report</th></tr>
<tr><td rowspan="5">Quaternary</td><td>Holocene</td><td>Quaternary alluvium</td><td colspan="2">Alluvial deposits</td><td rowspan="5">Chicot aquifer</td><td rowspan="5">Upper unit
Lower unit</td><td rowspan="5">Chicot aquifer</td><td rowspan="3">Upper unit</td></tr>
<tr><td rowspan="4">Pleistocene</td><td>Beaumont Formation</td><td rowspan="3">Beaumont Clay</td><td rowspan="2"></td></tr>
<tr><td>Montgomery Formation</td></tr>
<tr><td>Bentley Formation</td><td rowspan="2">"Alta Loma Sand"</td><td rowspan="2">Lower unit
"Alta Loma Sand"</td></tr>
<tr><td>Willis Sand</td><td>Zone 7
Zone 6</td></tr>
<tr><td rowspan="3">Tertiary</td><td>Pliocene</td><td>Goliad Sand</td><td colspan="2">Zone 5
Zone 4
Zone 3</td><td colspan="2">Evangeline aquifer</td><td colspan="2">Evangeline aquifer</td></tr>
<tr><td rowspan="2">Miocene</td><td>Fleming Formation</td><td colspan="2">Zone 2</td><td colspan="2">Burkeville confining layer</td><td colspan="2">Burkeville confining layer</td></tr>
<tr><td>Oakville Sandstone</td><td colspan="2">Zone 1</td><td colspan="2">Jasper aquifer</td><td colspan="2">Jasper aquifer</td></tr>
</table>



on of hydrologic units from northern Montgomery County to the Gulf of Mexico.

Evangeline Aquifer

The Evangeline aquifer, composed of the Goliad Sand and the upper part of the Fleming Formation, is similar in lithology to the Chicot aquifer. One difference between the two aquifers is that the Evangeline aquifer generally has a smaller hydraulic conductivity than does the Chicot aquifer. The contrast in hydraulic conductivity and a difference in water levels are the bases for separating the Evangeline aquifer from the Chicot aquifer. The altitude of the base of the Evangeline aquifer is shown in figure 4. The Evangeline aquifer is the major source of ground water in the Houston district. In Galveston and southern Harris Counties, water in the Evangeline aquifer is saline and is not used.

Jasper Aquifer

The Jasper aquifer is composed of interbedded sand and clay layers consisting almost entirely of terrigenous clastic sediments. The approximate altitude of the top of the Jasper aquifer is shown in figure 5. Because the Jasper aquifer underlies shallower aquifers, withdrawals from the Jasper aquifer in terms of total withdrawals in Harris County are not significant. However, hydraulically it is capable of yields of as much as 3,000 gal/min to wells in adjacent Montgomery County (Baker, 1983). Only the upper part of the Jasper aquifer is utilized in Harris County.

DEVELOPMENT OF GROUND WATER

Several publications document the historical development of ground-water withdrawals in the Houston district (Wood and Gabrysch, 1965; Gabrysch, 1972, 1980, 1982; Jorgensen, 1975; Carr and others, 1985). The areas discussed in this report are Houston, Katy, Pasadena, Baytown-LaPorte, Johnson Space Center, Texas City, and Alta Loma (fig. 6).

Prior to 1977, ground water was the major source of freshwater available in the Houston district. Small quantities of surface water obtained from Lake Houston on the San Jacinto River had been available in parts of the Houston district since 1954. The city of Galveston began using surface water from Lake Houston in 1973. In late 1976, surface water from Lake Livingston on the Trinity River became available. The availability of the increased surface water caused ground-water production to decrease substantially in all areas of the Houston district except the Katy area.

In areas to the north, west, and southwest of the Houston area (fig. 6), ground-water withdrawals for public supply have steadily increased due to urban expansion and the lack of surface water. The average daily ground-water withdrawals for public supply, industrial use, and irrigation in the Houston district during 1975-84 are listed in tables 2-4.

In general, until 1977, water levels in wells in the Houston district were declining. However, during the last several years, Houston and several adjacent areas have been converting from ground water to surface water as the main water supply. With the increasing conversion from ground-water use to surface-water use, water levels in wells in the Chicot and Evangeline aquifers began to rise

Table 2.--Average daily withdrawals of ground water in Harris County and parts of Fort Bend and Waller Counties, 1975-84

Area	Use	Ground-water withdrawals (million gallons per day)									
		1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Houston	Public supply:										
	City of Houston	150.7	163.4	185.2	188.9	203.0	219.7	217.5	221.4	180.3	186.5
	Surburban	23.5	24.8	28.5	29.4	22.9	27.4	25.3	29.5	27.6	28.9
	Industry	8.1	9.0	8.0	8.1	6.9	6.7	6.2	5.2	4.1	3.0
	Irrigation	.8	.8	.8	.9	.7	1.0	.7	.9	.5	.8
	Subtotal	183.1	198.0	222.5	227.3	233.5	254.8	249.7	257.0	212.5	219.2
Katy	Public supply	11.4	15.3	24.2	29.9	31.5	43.9	49.6	64.0	62.2	74.1
	Industry	11.6	10.8	12.9	14.2	13.1	16.5	13.6	11.2	12.2	13.4
	Irrigation	110.1	104.5	84.4	109.9	82.0	97.8	98.4	94.7	40.0	62.5
	Subtotal	133.1	130.6	121.5	154.0	126.6	158.2	161.6	169.9	114.4	150.0
Pasadena	Public supply	16.3	16.7	16.9	16.6	15.1	17.6	16.6	13.8	15.8	16.2
	Industry	93.9	89.1	66.4	46.3	33.0	30.6	28.1	25.0	25.8	23.7
	Subtotal	110.2	105.8	83.3	62.9	48.1	48.2	44.7	38.8	41.6	39.9
Baytown-LaPorte	Public supply	8.5	9.3	9.8	11.4	10.6	11.1	6.8	4.8	4.3	4.4
	Industry	17.6	17.2	12.3	10.2	3.8	1.8	.9	.8	1.0	.8
	Subtotal	26.1	26.5	22.1	21.6	14.4	12.9	7.7	5.6	5.3	5.2
Johnson Space Center	Public supply	6.5	4.9	3.4	4.0	3.4	4.5	3.9	4.6	4.1	4.1
	Industry	13.6	15.6	4.0	1.0	.5	.3	.2	.3	.2	.6
	Irrigation	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
	Subtotal	20.2	20.6	7.5	5.1	4.0	4.9	4.2	5.0	4.4	4.8
Other areas in Harris County	Public supply	5.6	5.3	6.6	7.2	8.7	11.9	11.9	14.1	12.5	16.8
	Industry	--	--	--	--	.3	.1	.1	.1	.1	.1
	Irrigation	.3	.7	.8	2.3	1.3	.9	1.5	.4	.6	1.2
	Subtotal	5.9	6.0	7.4	9.6	10.3	12.9	13.5	14.6	13.2	18.1
Total		478.6	487.5	464.3	480.5	436.9	491.9	481.4	490.9	391.4	437.2

in the eastern parts of Harris County. Although this report focuses on water-level changes during 1980-84, for long-term perspective, water-level changes from 1977 to 1985 in wells in the Chicot and Evangeline aquifers are shown in figures 7 and 8; 1977 was used as the base year for determining water-level changes because most conversions from ground water to surface water were made that year. During 1977-85, the water-level changes in wells in the Chicot aquifer in the Houston district ranged from rises of as much as about 140 ft to declines of as much as about 80 ft (fig. 7). Water levels in wells in the Evangeline aquifer from 1977 to 1985 ranged from rises of as much as about 120 ft to declines of as much as about 140 ft (fig. 8).

The water-level changes in wells in the Chicot and Evangeline aquifers during 5 years, spring 1980 to spring 1985, are shown in figures 9 and 10. The altitude of water levels in wells in the Chicot and Evangeline aquifers during spring 1985 are depicted in figures 11 and 12.

Only a few wells have been completed in the Jasper aquifer in Harris County. Three of these (LJ-60-60-306, LJ-60-61-210, and LJ-65-07-905) are located in the northern part of the county and two in the western part of the county (fig. 6). The two wells (LJ-65-03-501 and LJ-65-03-505) drilled in the western part of the county were once used as a water source for a health resort. Of the three wells drilled in northern Harris County, one (LJ-60-60-306) is used for public water supply. From 1980 through 1984, this well produced about 0.26 Mgal/d of water. Water from the second well (LJ-60-61-210) in northern Harris County is used to repressure oil-producing zones. No recent water-level information is available for this well, but in 1968, the well was flowing. The U.S. Geological Survey, in cooperation with the Harris-Galveston Coastal Subsidence District, drilled the third well (LJ-65-07-905), an exploratory well, to the Jasper aquifer near the Lake Houston dam in 1979. The water level of this well was 80 ft above land surface on December 3, 1979, compared to 68 ft above land surface on December 5, 1984.

Houston Area

The Houston area, located in central and south-central Harris County, includes most of the city of Houston and several densely urbanized areas adjacent to the city. The Evangeline aquifer supplies most of the ground water used in the Houston area. Some wells in the Houston area are screened in both the Chicot and Evangeline aquifers.

Ground-Water Withdrawals

The quantity of ground water used by the city of Houston increased from 1975 through 1982 (table 5). However, since 1982, the quantity of ground water used has rapidly decreased. Ground-water contribution to the total water supply for the city of Houston during 1984 was 50.5 percent, the smallest percentage since 1978. The quantities and percentages of ground water and surface water used by the city of Houston between 1975 and 1984 are listed in table 5. For most years since 1975, ground water has supplied slightly more than 50 percent of the total water supply with a mean of 53 percent for the 10 years. During 1984, ground-water withdrawals were 186.5 Mgal/d or 50.5 percent of the total water supply. Ground-water withdrawals during 1982 were 221.4 Mgal/d, a historical high. During 1982-84, ground-water withdrawals decreased by 34.9

Table 5.--Average daily use of ground water and surface water by the city of Houston, 1975-84

Year	Use (million gallons per day) Ground water	Surface water (treated plus untreated)	Total	Percentage of ground water to total
1975	150.7	148.8	299.5	50.3
1976	163.4	175.5	338.9	48.2
1977	185.2	184.6	369.8	50.1
1978	188.9	196.1	385.0	49.1
1979	203.0	171.1	374.1	54.3
1980	219.7	174.3	394.0	55.8
1981	217.5	167.1	384.6	56.6
1982	221.4	163.7	385.1	57.5
1983	180.3	157.2	337.5	53.4
1984	186.5	183.0	369.5	50.5

Mgal/d. The total water used by Houston also has decreased from the peak of 394.0 Mgal/d during 1980 to 369.5 Mgal/d during 1984. The reduction in total water use may be related to the depressed economic conditions existing in the Houston area during the past several years (1982-84). Precipitation records indicate the decrease in water use is not due entirely to climatic conditions. The average precipitation deviation during the summer months (June, July, and August), when water use is greatest, is shown for 1976-84 in figure 13. During 1981, summer precipitation was 10 in. greater than average and the total water used by the city of Houston was 384.6 Mgal/d. During 1982, summer precipitation was 3.7 in. less than normal, but, compared to 1981, total water use only increased by 0.5 Mgal/d to 385.1 Mgal/d (table 5). During 1983, summer precipitation was 9 in. greater than average and total water use decreased to 337.5 Mgal/d (table 5). Although some decrease would be expected because of increased summer precipitation, the total water use was the smallest since 1975 (table 5). During 1984, summer precipitation was 2.1 in. less than average and total water use increased to 369.5 Mgal/d (table 5). Although this increase was substantial compared to 1983, total water use was the second smallest since 1976 (table 5).

Changes in Water Levels

Water-level changes in wells in the Chicot aquifer from spring 1980 to spring 1985 ranged from rises of as much as about 60 ft in the eastern part of the Houston area to declines of as much as about 40 ft in the southwestern part of the area. In the eastern part of the Houston area, the water level rose about 7 ft in well LJ-65-14-738 (fig. 14) from January 1980 to January 1985. The hydrograph of well LJ-65-12-801 (fig. 14), completed in the Chicot aquifer and located in the western part of the Houston area, shows a water-level decline of about 12 ft during the same time.

Water levels in wells in the Evangeline aquifer rose as much as about 60 ft in the eastern part of the Houston area from 1980 to spring 1985 due to decreased ground-water withdrawals in the Houston and Pasadena areas (fig. 10). However, water levels in wells in the Evangeline aquifer declined as much as about 60 ft (fig. 10) in the western part of the Houston area due to continued ground-water withdrawals there and increased withdrawals in the adjacent Katy area. The hydrograph of well LJ-65-21-302 (fig. 14), located just south of the center of Houston, shows a water-level rise of 33 ft from January 1980 to January 1985. However, the water level in well LJ-65-20-216 (fig. 14), in the western part of the city of Houston, declined 23 ft from January 1980 to January 1985.

During spring 1985, the altitudes of water levels in wells in the Chicot aquifer were as much as 300 ft below sea level and in wells in the Evangeline aquifer they were as much as 350 ft below sea level.

Katy Area

Parts of Harris, Fort Bend, and Waller Counties comprise the Katy area (fig. 6). The area is predominantly rural, although housing subdivisions, commercial establishments, and light industries are commonplace in the northeastern one-half of the area. In terms of economic expansion, the Katy area was the fastest growing sector of the Houston district from 1980 through 1984.

REFERENCE 18

Report 236

STRATIGRAPHIC AND HYDROGEOLOGIC FRAMEWORK OF PART OF THE COASTAL PLAIN OF TEXAS

TEXAS DEPARTMENT OF WATER RESOURCES

July 1979

TEXAS DEPARTMENT OF WATER RESOURCES

REPORT 236

STRATIGRAPHIC AND HYDROGEOLOGIC FRAMEWORK OF PART OF THE COASTAL PLAIN OF TEXAS

By

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United States Geological Survey

This report was prepared by the U.S. Geological Survey under cooperative agreement with the Texas Department of Water Resources.

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STRATIGRAPHIC AND HYDROGEOLOGIC FRAMEWORK OF PART OF THE COASTAL PLAIN OF TEXAS

INTRODUCTION

This report has been prepared to illustrate the stratigraphic and hydrogeologic framework of a part of the Coastal Plain of Texas from the Sabine River to the Rio Grande. It is the outgrowth of a project that has as its ultimate objective the construction of a digital ground-water flow model, if feasible or desirable, of at least a part of the Miocene aquifers in the Gulf Coastal Plain of Texas. The model would serve as a tool for planning the development of the ground-water supplies. Work on the project is being done by the U.S. Geological Survey in cooperation with the Texas Department of Water Resources.

During the course of delineating the Miocene aquifers, which is basic to the design and development of the model, the scope of the study was broadened to include delineations of other hydrogeologic units, as well as delineations of stratigraphic units. As a result, units ranging in age from Paleocene to Holocene were delineated (Table 1). A relationship of stratigraphic units to designated hydrogeologic units was thus established statewide.

Eleven dip sections and 1 strike section are included in this report. The dip sections are spaced about 50 miles (80 km) apart with the most easterly one being near the Sabine River and the most southerly one being near the Rio Grande. Each dip section is about 100 miles (161 km) long and extends from near the coastline to short distances inland from the outcrop of the oldest Miocene formation—the Catahoula Tuff or Sandstone. The strike section, which is about 500 miles (804 km) long (in three segments), extends from the Sabine River to the Rio Grande and joins the dip sections at common control points. This section is from 50-75 miles (80-121 km) inland from the Gulf of Mexico and is essentially parallel to the coastline. The location of the sections and the Catahoula outcrop are shown on Figure 1.

The sections extend from outcrops at the land surface to maximum depths of 7,600 feet (2,316 m) below sea level. Selected faunal occurrences, where known or inferred by correlation from nearby well logs, are included. The extent of sand that contains water having less than 3,000 mg/l (milligrams per liter) of dissolved solids was estimated from the electrical characteristics shown by the logs. This information is included on all of the sections.

Although faulting is common in the Coastal Plain and is complex in some areas, all faults have been omitted from the sections to maintain continuity of the stratigraphic and hydrogeologic boundaries. The disadvantage of such omission is, of course, the representation of an unrealistic and simplistic picture of unbroken strata with uninterrupted boundaries. In reality, many of the faults have not only broken the hydraulic continuity of the strata but more importantly have become barriers to fluid flow or conduits for cross-formational flow. The sections are presented in this report as Figures 2-15.

Acknowledgements

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Table 1.--Stratigraphic and Hydrogeologic Framework of Part of the Coastal Plain of Texas

Era	System	Series	Stratigraphic Units	Hydrogeologic Units	Selected Faunal Markers	Remarks
CENOZOIC	Quaternary	Holocene	Alluvium	Chicot aquifer		Quaternary System undifferentiated on sections.
		Pleistocene	Beaumont Clay			
			Montgomery Formation			
			Bentley Formation			
			Willis Sand			
	Tertiary	Pliocene	Goliad Sand	Evangeline aquifer		Goliad Sand overlapped east of Lavaca County.
		Miocene	Fleming Formation	Burkeville confining system	*Potamides matsoni* *Bigenerina nodosaria var. directa* *Bigenerina humblei* *Amphistegina sp.*	
			Oakville Sandstone	Jasper aquifer		Oakville Sandstone included in Fleming Formation east of Washington County.
		? ?	Surface: Catahoula Tuff or Sandstone Subsurface: Upper part of Catahoula Tuff or Sandstone	Catahoula confining system (restricted)	*Discorbis nomada* *Discorbis gravelli* *Heterostegina sp.* *Marginulina idiomorpha*	Catahoula Tuff designated as Catahoula Sandstone east of Lavaca County.
			Subsurface: Anahuac Formation			Anahuac and "Frio" Formations may be Oligocene in age.
			Subsurface: "Frio" Formation		*Textularia mississippiensis*	
		Oligocene(?)	Surface: Frio Clay Subsurface: Vicksburg Group equivalent	Not discussed as hydrologic units in this report.	*Textularia warreni*	Frio Clay overlapped or not recognized on surface east of Live Oak County.
		? ?	Jackson Group — Whitsett Formation: Fashing Clay Member			Indicated members of Whitsett Formation apply to south-central Texas. Whitsett Formation east of Karnes County may be, in part or in whole, Oligocene in age.
			Jackson Group — Whitsett Formation: Calliham Sandstone Member or Tordilla Sandstone Member			
			Jackson Group — Whitsett Formation: Dubose Member		*Marginulina cocoaensis*	
			Jackson Group — Whitsett Formation: Deweesville Sandstone Member			
			Jackson Group — Whitsett Formation: Conquista Clay Member		*Textularia hockleyensis*	
			Jackson Group — Whitsett Formation: Dilworth Sandstone Member		*Massilina pratti*	
		Eocene	Jackson Group — Manning Clay			
			Jackson Group — Wellborn Sandstone		*Textularia dibollensis*	
			Jackson Group — Caddell Formation			
			Claiborne Group — Yegua Formation		*Nonionella cockfieldensis* *Discorbis yeguaensis* *Eponides yeguaensis* *Ceratobulimina eximia*	
			Claiborne Group — Cook Mountain Formation			
			Claiborne Group — Sparta Sand			
			Claiborne Group — Weches Formation			
			Claiborne Group — Queen City Sand			
			Claiborne Group — Reklaw Formation			
			Claiborne Group — Carrizo Sand			
			Wilcox Group			
		Paleocene	Midway Group			

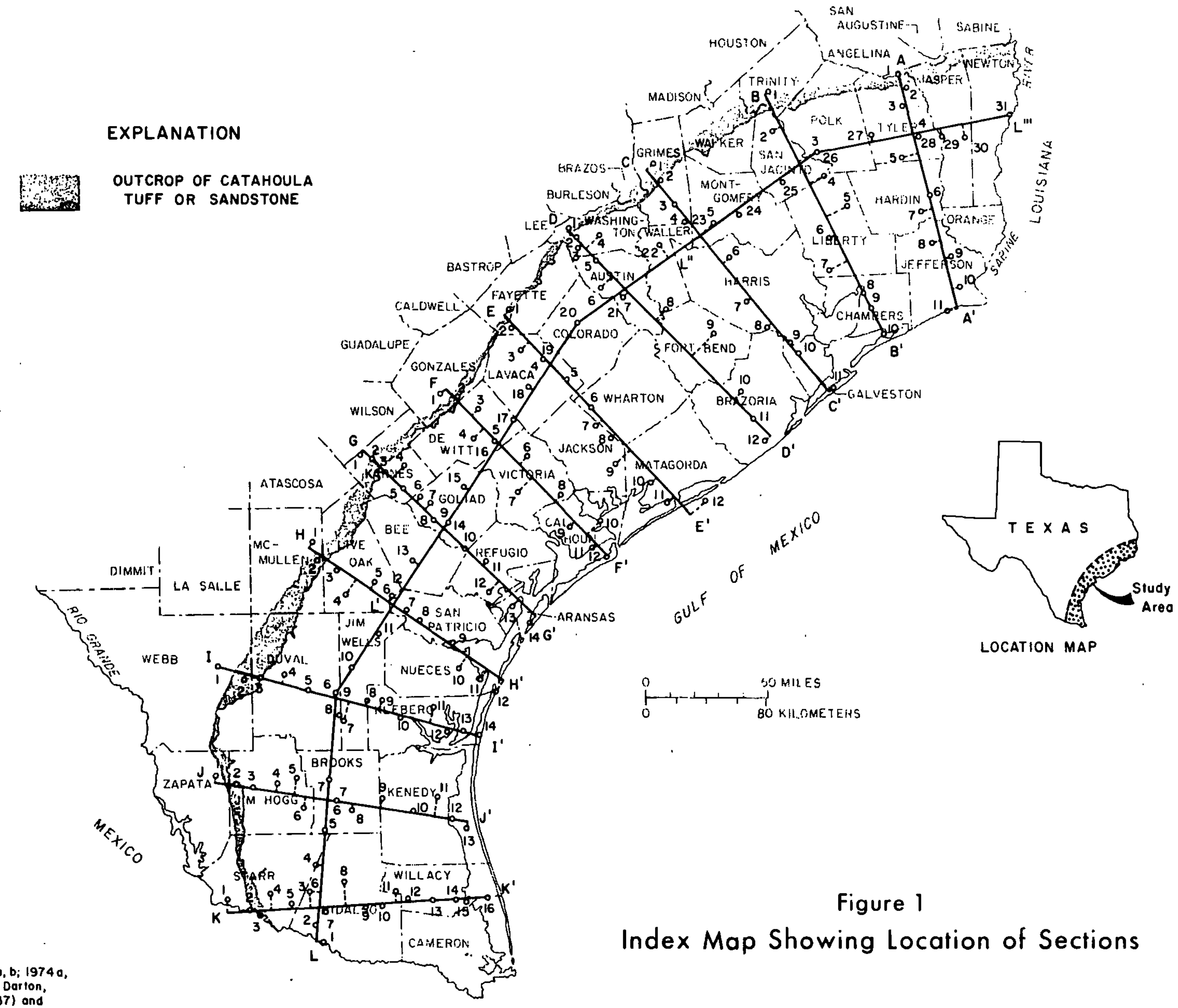

Figure 1
Index Map Showing Location of Sections

Geology from Barnes (1968a, b; 1974a, b; 1975) and modified from Darton, Stephenson, and Gardner (1937) and from Barnes (1976a, b, c)

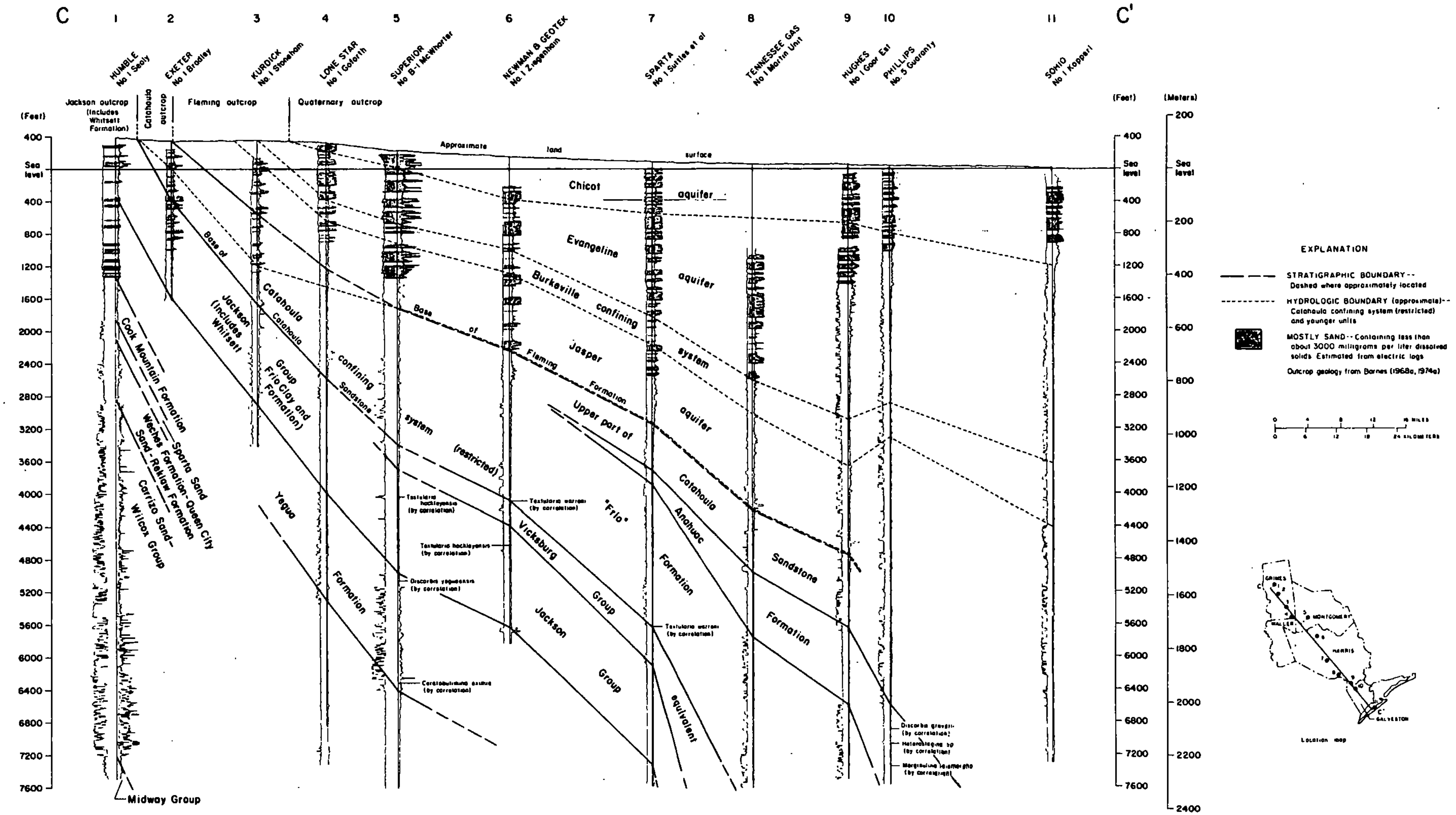

Figure 4
Stratigraphic and Hydrogeologic Section C-C'

and W. M. Sandeen (U.S. Geological Survey) of Houston, Texas, delineated the Chicot and Evangeline aquifers on the sections. Their contribution is gratefully acknowledged. Geologic sections and type logs of oil fields including faunal occurrences by the Houston Geological Society (1954, 1962), the Corpus Christi Geological Society (1954, 1955, 1967, 1972), and the South Texas Geological Society (1962, 1967) were extensively utilized as aids in identifying deep subsurface formations. The geologic sections of Eargle, Dickinson, and Davis (1975) served to identify near-surface formations in parts of South Texas.

Metric Conversions

For those readers interested in using the metric system, the metric equivalents of English units of measurements are given in parentheses. The English units used in this report have been converted to metric units by the following factors:

From	Multiply by	To obtain
feet	0.3048	meters (m)
miles	1.609	kilometers (km)

STRATIGRAPHIC FRAMEWORK

General Features of Deposition and Correlation Problems

Cenozoic sediments that underlie the Coastal Plain of Texas are tens of thousands of feet thick at the coastline. These clastic sediments of sand, silt, and clay represent depositional environments ranging from nonmarine at the outcrops of most units to marine where the units may carry a distinctive suite of fossils. Oscillations of ancient seas and changes in amount and source of sediments that were deposited caused facies changes downdip and along strike. For example, a time-stratigraphic unit having age equivalency may consist of sand in one area, sandy clay in a second area, and clay in a third area. Subsidence of the basin of deposition and rising of the land surface caused the stratigraphic units to thicken Gulfward. Growth faults (faults that were more or less continuously active) greatly increased the thickness of some stratigraphic units in short distances. All of these factors contributed to the heterogeneity of the units from place to place, which in turn makes correlation difficult.

Stratigraphic Units

In the discussion to follow, emphasis will be placed on stratigraphic units that are designated in this report as Miocene in age. Many of the correlation problems of the Cenozoic deposits involve these units to a large degree. Also the main thrust of this report is directed at the Miocene in keeping with the ultimate objective of modeling the flow in the Miocene aquifers.

The stratigraphic nomenclature used in this report was determined from several sources and may not necessarily follow the usage of the U.S. Geological Survey.

Pre-Miocene

Delineation of most of the pre-Miocene units of Cenozoic age present relatively few problems of significance. This is especially true of the pre-Jackson units (Midway Group to Yegua Formation). The top of the Carrizo Sand of the Claiborne Group (included with the underlying Wilcox Group on the sections) can be easily delineated, which makes the position of the unit unmistakable in the subsurface. From about the Sabine River to the San Marcos Arch (section F-F', Figure 7, is centered over this structural feature), the top of the Carrizo-Wilcox is about 3,000 feet (914 m) beneath the landward edge of the Catahoula outcrop. Southward from the San Marcos Arch into the Rio Grande Embayment of South Texas, its position steadily increases in depth to more than 7,000 feet (2,134 m) at the western end of section K-K' (Figure 12).

Facies changes occur downdip in the Sparta and Queen City Sands of the Claiborne Group, and where these units grade into clay, delineation on a time-stratigraphic basis is virtually impossible from electrical-log interpretation. The same problem affects the Yegua Formation of the Claiborne Group, although the Yegua remains sandy for greater distances downdip. It can be delineated by lithology on most of the sections in this report. Also, the presence of important faunal markers such as *Nonionella cockfieldensis* and *Ceratobulimina eximia* aid in locating the approximate top and base, respectively, of the Yegua, regardless of its lithology.

The delineation of the Jackson Group is significant in establishing the framework for the Miocene units. This is because the outcropping Frio Clay of Oligocene(?) age of South Texas is completely overlapped in Live Oak County by the Miocene Catahoula (or is not recognized on the surface east of this area). The overlap places the Catahoula in contact with part of the Whitsett Formation, the uppermost formation of the Jackson Group in this area. East of the overlap to the Sabine River, careful attention was required to properly separate on the sections the tuffaceous sand and clay interbeds of the Whitsett from the tuffaceous sand and clay interbeds of the overlying Catahoula. From Live Oak County southward, the outcropping Frio Clay separates the Whitsett Formation from the Catahoula Tuff.

The age of the Whitsett, although shown in Table 1 as Eocene in South-Central Texas, may be at least in part Oligocene in the eastern part of the State. Eargle, Dickinson, and Davis (1975) consider the Whitsett to be Eocene at least from central Karnes County to southern McMullen County. Barnes (1975) likewise considers the Whitsett to be unquestionably Eocene no farther east than central Karnes County. From this area to the Sabine River, Dr. V. E. Barnes (written commun., April 5, 1971) states that the Whitsett may "climb timewise eastward" and be largely Oligocene in East Texas; that the Nash Creek Formation of Louisiana, which is considered to be largely Oligocene, is equivalent to the Whitsett as mapped in Texas near the Sabine River; and the Oligocene vertebrates, which Dr. J. A. Wilson (Department of Geologic Sciences, University of Texas at Austin) collected from the Whitsett in Washington County, show that this formation is at least part Oligocene at that site. Because of the probability that the Whitsett is Oligocene, in part or in whole in much of the area, the delineation of the Eocene Jackson Group is shown on the sections to include the Whitsett Formation.

The Frio Clay of Oligocene(?) age has been a controversial unit for decades. Geologists still do not agree on its subsurface equivalents or if it is even a separate stratigraphic unit from the Catahoula. The fact that many geologists have mapped the unit from Live Oak County to the Rio Grande lends support to the existence of the Frio Clay as a formation. The Geologic Atlas of Texas (Barnes, 1976a,b,c) shows that the Frio is mapped separately as a distinct formation from its overlap in Live Oak County to southern Webb County; from there to the Rio Grande, the Frio is undifferentiated from the Catahoula. The Frio outcrop that was used for control at the surface on the dip sections H-H' to K-K' (Figures 9-12) was modified from Darton, Stephenson, and Gardner (1937) and from Barnes (1976a,b,c). East of the overlap in Live Oak County the Frio is presumed to be present in the shallow subsurface beneath the Catahoula with the erosional edge probably only a few miles downdip from the edge of the Catahoula outcrop.

The Frio Clay at the surface has been interpreted by the author to be, at least in part, the nonmarine time-equivalent of the subsurface Vicksburg Group—a marine biostratigraphic unit of Oligocene age that crops out east of the Sabine River and is characterized by the foraminifer *Textularia warreni*. The relationship is supported by Deussen and Owen (1939, p. 1630) and by the Houston Geological Society (1954). The Vicksburg equivalent east of Karnes County may also be at least a partial time-equivalent of the Whitsett, whose probable Oligocene age in this area may, in itself, indicate an equivalency. Ellisor (1944, Figure 1, and p. 1365) supports this probability and illustrates the relationship in a geologic section. Additionally, this probability is supported by the apparent correlation of the outcrop of the Vicksburg Group in Louisiana near the Sabine River as shown on the geologic map of Louisiana (Wallace, 1946) with the outcrop of the Whitsett Formation as shown on the Geologic Atlas of Texas (Barnes, 1968b). This relationship may be inferred on the dip sections from A-A' to at least F-F' (Figures 2-7) where the Vicksburg equivalent, if projected to the outcrop, would intersect the outcropping Whitsett.

Miocene

The stratigraphic framework of the units that are designated in this report as Miocene in age is complex and controversial, perhaps more so than any other Cenozoic units. Geologists do not agree which units on the surface or in the subsurface are Miocene nor do they agree as to the relationship of the surface and subsurface units. The correct relationship may never be determined because faunal markers, which exist in places in the subsurface, do not extend to the outcrop; and the heterogeneity of the sediments does not facilitate electrical-log correlations.

The outcropping stratigraphic units that are assigned to the Miocene in this report are, from oldest to youngest, the Catahoula Tuff or Sandstone, Oakville Sandstone, and Fleming Formation. The "Frio" Formation, Anahuac Formation, and a unit that is referred to in this report as the upper part of the Catahoula Tuff or Sandstone are assigned by the author as possible downdip equivalents of the surface Catahoula although the Anahuac and "Frio" Formations may be Oligocene in age. Table 1 and the dip sections (Figures 2-12) illustrate this relationship.

The outcrop of the Catahoula, a pyroclastic and tuffaceous unit, has been mapped independently by various geologists with little modification from the Sabine River to the Rio Grande. Darton, Stephenson, and Gardner (1937) modified the unit's name from Catahoula Tuff to Catahoula Sandstone east of Lavaca County where the formation becomes more sandy.

It may be seen on the sections that the thickness of the surface Catahoula increases downdip at a large rate in the subsurface to eventually include, when the Anahuac Formation is reached, the "Frio" Formation which underlies the Anahuac, and the upper Catahoula unit. Deussen and Owen (1939, Figures 5, 6, p. 1632, and Table 1), in a study of the surface and subsurface formations in two typical sections of the Texas Coastal Plain (one in East Texas, the other in South Texas), agree with this relationship. They disagree, however, with these units being Miocene and assign them to the Oligocene. Some oil-company geologists consider the Anahuac and "Frio" as separate formations (unrelated to the Catahoula) in the subsurface and also assign them to the Oligocene. As a consequence of this usage, the upper Catahoula unit of this report is then usually referred to as "Miocene," which term is used instead of, or interchangeably with, Fleming. Holcomb (1964, Figure 2) in a study of the subsurface "Frio" Formation of South Texas places the "Frio" and Anahuac Formations, as well as the surface Catahoula in the Miocene, but does not admit to any Catahoula occurring above the Anahuac. He indicates that the "Fleming Formation" (Oakville Sandstone and Fleming Formation of this report) rests on the Anahuac. Dip sections, especially F-F', G-G', and H-H' (Figures 7-9), show unmistakably that the Catahoula-Oakville contact on the surface can be accurately traced far enough downdip by means of electrical logs to show that the clearly discernible contact is several hundred feet above the Anahuac. For this reason, the upper Catahoula unit above the Anahuac cannot be the Oakville. This contention is supported by Meyer (1939, p. 173) and by Lang, Winslow, and White (1950, Plate 1).

The Anahuac Formation, despite the controversial attention it receives, is one of the most discernible formations in the subsurface. This marine biostratigraphic unit carries a rich microfauna of many tens of diagnostic species. These species are categorized into the *Discorbis* zone, *Heterostegina* zone, and *Marginulina* zone, from youngest to oldest. Only a few of the diagnostic species (Table 1) are included with the dip sections in this report. The updip limit of the marine facies of the Anahuac ranges in depth from about 2,500 feet (762 m) below land surface in East Texas to about 4,000 feet (1,219 m) in the Rio Grande Embayment in South Texas. The unit is quite sandy south of the San Patricio County (south of section H-H', Figure 9) to the Rio Grande in contrast to its shaly character eastward from San Patricio County to the Sabine River.

The Oakville Sandstone and Fleming Formation are composed almost entirely of terrigenous clastic sediments that form sand and clay interbeds. Both formations are basically rock-stratigraphic units that are distinguished and delineated on the basis of lithologic characteristics. Their boundaries in the Coastal Plain of Texas are discernible contacts in some areas and arbitrary ones within zones of lithologic gradation in other areas.

The Oakville Sandstone is most prominent on the surface and in the subsurface in the central part of the Coastal Plain. Here its predominantly sandy character is distinguished from the underlying tuffaceous Catahoula and overlying Fleming, which is composed of clay and slightly subordinate amounts of sand.

The Oakville on the surface has been mapped as a formation from about the Brazos River at the Washington-Grimes County line to central Duval County, where its outcrop is overlapped by the Goliad Sand and remains overlapped to the Rio Grande. Beneath this overlap, the Oakville apparently decreases in thickness or loses its predominance of sand or both. In either case, its position in the shallow subsurface in parts of the Rio Grande Embayment is questionable on dip sections I-I' and K-K' (Figures 10, 12). In the vicinity of the Brazos River, the Oakville grades eastward into the base of the Fleming Formation and loses its identity. The position of the base of the Oakville in the deeper parts of the subsurface has been delineated on some of the sections merely as an approximation.

The Fleming Formation, the uppermost unit of Miocene age in the Coastal Plain, has been mapped on the surface in Texas from the Sabine River to central Duval County. From here, like the Oakville, it is overlapped by the Goliad Sand and remains beneath the Goliad to the Rio Grande.

The Fleming is lithologically similar to the Oakville but can be easily separated from the Oakville in some places by its greater proportion of clay. Plummer (1932, p. 744, 747) described the Lagarto as consisting of 75 percent marl or clay, 15 percent sand, and 10 percent silt, with the clay beds being thicker and more massive and the sand beds being thinner and less massive than those of the Oakville. This description is reasonably accurate in some areas of the outcrop and shallow subsurface where the Fleming is separated from the Oakville. (See sections I-I', J-J', and L-L', Figures 10, 11, and 13.) In other areas, the Fleming on the outcrop and in the shallow subsurface contains a ratio of sand to clay that approximates that of the Oakville. Where the Fleming Formation is not separated from the Oakville and directly overlies the Catahoula, from about Grimes

County to the Sabine River, the percentage of sand in the formation increases eastward. In Jasper and Newton Counties, the amount of sand in the section above the base of the Fleming greatly exceeds the amount of clay. This can be seen in wells 30 and 31 on strike section L''-L''' (Figure 15).

Delineation of the base of the Fleming from the to the deep subsurface has not been attempted on most of the sections because of complex facies changes. In southeast Texas on sections A-A', B-B', and C-C' (Figures 2-4), an approximate base of the Fleming is shown downdip to short distances beyond the pinchout of the Anahuac. The preponderance of sand above the Anahuac in this area, however, makes any delineation on the basis of electrical logs speculative. Deep wells near the coastline penetrate marine facies of the Fleming which carry a diagnostic fauna. Numerous species, which serve to identify the formation, have been described by Rainwater (1964). *Potamides matsoni*, *Amphistegina sp.*, *Bigenerina humblei,* and *Bigenerina nodosaria var. directa* are faunal markers indicated on some of the sections.

Post-Miocene

Delineation of the stratigraphic units of Pliocene, Pleistocene, and Holocene age has not been attempted. Correlation problems with most of these stratigraphic units are too numerous to solve by using only electrical logs. Delineation of the Pleistocene units—Willis Sand, Bentley Formation, Montgomery Formation, and Beaumont Clay—is exceedingly difficult due to the lithologic similarity of the sediments and lack of paleontological control. The contact at the surface of the basal Quaternary with the Goliad Sand or older units is, however, shown on the dip sections.

The Goliad Sand of Pliocene age overlies the Miocene units in the deep subsurface as well as in places on the surface. Except for a few isolated outcrops, it is otherwise entirely overlapped on the surface east of Lavaca County by Pleistocene deposits. Its inland extent beneath the overlap is presumed to be only several miles southeast from the most downdip exposures of the Fleming Formation. From Lavaca County to the Rio Grande, the width of the Goliad outcrop gradually increases because the Goliad progressively overlaps older units in the Rio Grande Embayment of South Texas.

The Goliad Sand can usually be identified on the surface and in the subsurface by a preponderance of sand except in the far eastern part of the State where sand predominates from the base of the Miocene to the surface. In this area, the identity of the Goliad cannot be established with certainty. Delineation of the base of the Goliad has been made, where outcrop control is available, on the strike and dip sections west of Colorado County. The base of the Goliad has been approximated at about 2,200 feet (671 m) below sea level near the coastline on sections I-I' and J-J' (Figures 10, 11).

HYDROGEOLOGIC FRAMEWORK

The following discussion is restricted to the hydrogeologic framework of five units—Catahoula confining system (restricted), Jasper aquifer, Burkeville confining system, Evangeline aquifer, and Chicot aquifer. A discussion of other hydrologic units of Cenozoic age is beyond the purpose and scope of this report.

The quality of the ground water that is indicated on the sections to be less than 3,000 mg/l of dissolved solids is referred to in this report as fresh to slightly saline water. This terminology follows the classification of Winslow and Kister (1956).

Catahoula Confining System (Restricted)

The Catahoula confining system (restricted) is treated in this report as a quasi-hydrologic unit with different boundaries in some areas than the stratigraphic unit of the same name. Its top (base of the Jasper aquifer) is delineated along lithologic boundaries that are time-stratigraphic in some places but that transgress time lines in other places. Its base, which coincides with the base of the stratigraphic unit, is delineated everywhere along time-stratigraphic boundaries that are independent of lithology. No attempt was made to establish a lithologic (hydrologic) base for the unit, which would have created a distinct hydrologic unit. Such effort would have involved a thorough hydrologic evaluation of pre-Miocene formations, which is beyond the scope of the project.

In many places, the Catahoula confining system (restricted) is identical to the stratigraphic unit, but there are notable exceptions. These departures of the hydrologic boundaries from the stratigraphic boundaries are most prominent in the eastern part of the Coastal Plain near the Sabine River (Figure 15), in places in South Texas (Figure 11), and in numerous places at the outcrop and in the shallow subsurface. In these places, the very sandy parts of the Catahoula Tuff or Sandstone (stratigraphic unit) that lie immediately below the Oakville Sandstone or Fleming Formation are included in the overlying Jasper aquifer. This leaves a lower section from 0 to 2,000 feet (610 m) or more in thickness that consists predominantly of clay or tuff with some interbedded sand to compose the Catahoula confining (restricted) system. In most areas, this delineation creates a unit that is generally deficient in sand so as to preclude its classification in these areas as an aquifer. Thus in much of its subsurface extent, the Catahoula confining system (restricted) functions hydrologically as a confining layer that retards the interchange of water between the overlying Jasper aquifer and underlying aquifers.

The amount of clay and other fine-grained clastic material in the Catahoula confining system (restricted) generally increases downdip, until the Anahuac Formation is approached. Below this unit, the "Frio" Formation becomes characteristically sandy and contains highly saline water that extends to considerable depths.

Jasper Aquifer

The Jasper aquifer, which was named by Wesselman (1967) for the town of Jasper in Jasper County, Texas, has heretofore not been delineated farther west than Washington, Austin, and Fort Bend Counties. In this report, a delineation as far downdip as possible has been made of the Jasper from the Sabine River to the Rio Grande.

The configuration of the Jasper aquifer in the subsurface, as shown on the sections, is geometrically irregular. This irregularity is due to the fact that the delineation was necessarily made on the basis of the aquifer being a rock-stratigraphic unit. The hydrologic boundaries were defined by observable physical (lithologic) features rather than by inferred geologic history.

The configuration of the base and top of the Jasper transgresses stratigraphic boundaries along strike and downdip. The lower boundary of the aquifer coincides with the stratigraphic lower boundary of the Oakville or Fleming in some places. In other places the base of the Jasper lies within the Catahoula or coincides with the base of that unit. The top of the aquifer is within the Fleming Formation in places, follows the top of the Oakville Sandstone in other places, and is within the Oakville in still other places.

The Jasper ranges in thickness from as little as 200 feet (61 m) to about 3,200 feet (975 m). The maximum thickness occurs within the region of highly saline water in the aquifer. An average range in thickness of the aquifer within the zone of fresh to slightly saline water is from about 600 to 1,000 feet (183 to 305 m). In the eastern part of the Coastal Plain of Texas the Jasper contains a greater percentage of sand than in the southern part. At the Sabine River, the Jasper attains a thickness of 2,400 feet (732 m) in well 31 on section L''-L''' (Figure 15), where the aquifer is composed almost entirely of sand. Fresh to slightly saline water, as shown on section D-D' (Figure 5), occurs as deep as 3,000 feet (914 m) below sea level.

Delineation of the Jasper aquifer in Louisiana (Whitfield, 1975), in western Louisiana and eastern Texas (Turcan, Wesselman, and Kilburn, 1966), and in Jasper and Newton Counties, Texas (Wesselman, 1967) shows that the thickness of the Jasper at the Sabine River closely approximates that given by the author. For example, the author assigns a thickness of 2,400 feet (732 m) to the Jasper in well 31 on section L''-L''' (Figure 15), and the authors cited above show essentially the same thickness at the site. This agreement in aquifer thickness, however, is contrasted to different interpretations of the stratigraphic composition or age of the aquifer near the Sabine River. The authors cited above restrict the Jasper to a part of the Fleming Formation, whereas this paper redefines the Jasper at its type locality near the Sabine River to include the upper part of the Catahoula of Texas in addition to the lower part of the Fleming of Texas. (This redefinition applies only to the area of the type locality and is thus only locally valid. Elsewhere in the Coastal Plain of Texas the Jasper assumes a different stratigraphic makeup.)

The stratigraphic discrepancies at the Texas-Louisiana border are attributed to different interpretations of the surface geology at the State line. The Palestine quadrangle of the Geologic Atlas of Texas (Barnes, 1968b) shows the Catahoula outcrop to be about 6 miles (9.7 km) wide at the Sabine River, whereas Welch (1942) shows the outcrop in Louisiana to be about 1 mile (1.6 km) wide. A close comparison of the two geologic maps indicates that in Louisiana the Lena, Carnahan Bayou, and at least part of the Dough Hills Members of Fisk (1940) of the Fleming Formation of Kennedy (1892), in addition to the Catahoula of Welch (1942), are equivalent to the Catahoula of Texas. Wesselman (1967) assigned the Carnahan Bayou Member as the basal part of the Jasper, which is reasonable; but this member is Catahoula in age in Texas. As long as the discrepancy in geologic mapping is unresolved, subsurface correlations of the Catahoula-Fleming contact, as well as formation thicknesses, will continue to differ.

Burkeville Confining System

The Burkeville confining system, which was named by Wesselman (1967) for outcrops near the town of Burkeville in Newton County, Texas, is delineated on the sections from the Sabine River to near the Rio Grande. It separates the Jasper and Evangeline aquifers and serves to retard the interchange of water between the two aquifers.

The Burkeville has been mapped in this report as a rock-stratigraphic unit consisting predominantly of silt and clay. Boundaries were determined independently from time concepts although in some places the unit appears to possess approximately isochronous boundaries. In most places, however, this is not the case. For example, the entire thickness of sediment in the Burkeville confining system in some areas is younger than the entire thickness of sediment in the Burkeville in other places.

The configuration of the unit is highly irregular. Boundaries are not restricted to a single stratigraphic unit but transgress the Fleming-Oakville contact in many places. This is shown on sections D-D' to G-G' and J-J' (Figures 5-8 and 11). Where the Oakville Sandstone is present, the Burkeville crops out in the Fleming but dips gradually into the Oakville because of facies changes from sand to clay downdip.

The typical thickness of the Burkeville ranges from about 300 to 500 feet (91 to 152 m). However, thick sections of predominantly clay in Jackson and Calhoun Counties account for the Burkeville's gradual increase to its maximum thickness of more than 2,000 feet (610 m) as shown on section F-F' (Figure 7).

The Burkeville confining system should not be construed as a rock unit that is composed entirely of silt and clay. This is not typical of the unit, although examples of a predominance of silt and clay can be seen in some logs in sections H-H' and I-I' (Figures 9-10). In most places, the Burkeville is composed of many individual sand layers, which contain fresh to slightly saline water; but because of its relatively large percentage of silt and clay when compared to the underlying Jasper aquifer and overlying Evangeline, the Burkeville functions as a confining unit.

Evangeline Aquifer

The Evangeline aquifer, which was named and defined by Jones (Jones, Turcan, and Skibitzke, 1954) for a ground-water reservoir in southwestern Louisiana, has been mapped also in Texas, but heretofore has been delineated no farther west than Washington, Austin, Fort Bend, and Brazoria Counties. Its presence as an aquifer and its hydrologic boundaries to the west have been a matter of speculation. D. G. Jorgensen, W. R. Meyer, and W. H. Sandeen of the U.S. Geological Survey (written commun., March 1, 1976) recently refined the delineation of the aquifer in previously mapped areas and continued its delineation to the Rio Grande. The boundaries of the Evangeline as they appear on the sections in this report are their determinations.

The Evangeline aquifer has been delineated in this report essentially as a rock-stratigraphic unit. Although the aquifer is composed of at least the Goliad Sand, the lower boundary transgresses time lines to include sections of sand in the Fleming Formation. The base of the Goliad Sand at the outcrop coincides with the base of the Evangeline only in South Texas as shown in sections H-H' to K-K' (Figures 9-12). Elsewhere, the Evangeline at the surface includes about half of the Fleming outcrop. The upper boundary of the Evangeline probably follows closely the top of the Goliad Sand where present, although this relationship is somewhat speculative.

The Evangeline aquifer is typically wedge shaped and has a high sand-clay ratio. Individual sand beds are characteristically tens of feet thick. Near the outcrop, the aquifer ranges in thickness from 400 to 1,000 feet (122 to 305 m), but near the coastline, where the top of the aquifer is about 1,000 feet (305 m) deep, its thickness averages about 2,000 feet (610 m). The Evangeline is noted for its abundance of good quality ground water and is considered one of the most prolific aquifers in the Texas Coastal Plain. Fresh to slightly saline water in the aquifer, however, is shown to extend to the coastline only in section J-J' (Figure 11).

Chicot Aquifer

The Chicot aquifer, which was named and defined by Jones (Jones, Turcan, and Skibitzke, 1954) for a ground-water reservoir in southwestern Louisiana, is the youngest aquifer in the Coastal Plain of Texas. Over the years, the aquifer gradually was mapped westward from Louisiana into Texas where, heretofore, its most westerly mapped limit was Austin, Fort Bend, and Brazoria Counties. In this report, the delineation of the Chicot was refined in previously mapped areas and extended to near the Rio Grande by D. G. Jorgensen, W. R. Meyer, and W. M. Sandeen of the U.S. Geological Survey (written commun., March 1, 1976).

It is believed that the base of the Chicot in some areas has been delineated on the sections in this report as the base of the Pleistocene. Early work in Southeast Texas indicates that the Chicot probably comprises the Willis Sand, Bentley Formation, Montgomery Formation, and Beaumont Clay of Pleistocene age and any overlying Holocene alluvium (Table 1). The problem that arises in this regard is that the base of the Pleistocene is difficult to pick from electrical logs. Thus any delineation of the base of the Chicot in the subsurface as the base of the Pleistocene is automatically suspect. At the surface, the base of the Chicot on the sections has been picked at the most landward edge of the oldest undissected coastwise terrace of Quaternary age. In practice, the delineation of the Chicot in the subsurface, at least on the sections in Southeast Texas, has been based on the presence of a higher sand-clay ratio in the Chicot than in the underlying Evangeline. In some places, a prominent clay layer was used as the boundary. Differences in hydraulic conductivity or water levels in some areas also served to differentiate the Chicot from the Evangeline.

The high percentage of sand in the Chicot in Southeast Texas, where the aquifer is noted for its abundance of water, diminishes southwestward. Southwest of section G-G' (Figure 8) the higher clay content of the Chicot and the absence of fresh to slightly saline water in the unit is sharply contrasted with the underlying Evangeline aquifer that still retains relatively large amounts of sand and good quality water.

REFERENCE 19

RECORD OF COMMUNICATION

Reference 19

TYPE: Outgoing Phone Call **DATE:** 5-11-92 **TIME:** 3:05 p.m

TO:
Ms.Katahlie
City of Houston
Water Engineering Department
(713)-247-1000

FROM:
Kevin Jaynes
Site Manager
ICF Technology Incorporated
214-979-3900

SUBJECT: West Houston Ground Water Wells

SUMMARY OF COMMUNICATION:

Ms. Katahlie explained that the Houston system is a blended system with 216 wells and surface water. The system serves those within the city limits, total population of the City of Houston. They do not figure the number of connections per well since each well is pumped to a water tank and then sent to distribution as needed.

REFERENCE 20

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN HARRIS AND GALVESTON COUNTIES, TEXAS, 1980-84

U.S. GEOLOGICAL SURVEY
Open-File Report 87-378

Prepared in cooperation with the
CITY OF HOUSTON and the
HARRIS-GALVESTON COASTAL SUBSIDENCE DISTRICT

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN HARRIS AND GALVESTON COUNTIES, TEXAS, 1980-84

By James F. Williams, III, L.S. Coplin, C.E. Ranzau, Jr.,
W.B. Lind, C.W. Bonnet, and Glenn L. Locke

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1987

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METRIC CONVERSIONS

Factors for converting inch-pound units to metric (International System) units are given in the following table:

Multiply inch-pound unit	By	To obtain metric units
foot (ft)	0.3048	meter
gallon per minute (gal/min)	0.06309	liter per second
inch	25.4	millimeter

National Geodetic Vertical Datum of 1929 (NGVD of 1929): A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "mean sea level."

Table 1.--Records of Wells in Harris County--Continued

Well	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Screen: Length (feet)	Screen: Depth interval (feet)	Water-bearing unit	Altitude of land surface (feet)	Water level: Below land surface datum (feet)	Water level: Date of measurement	Use of water	Discharge (gallons per minute)	Drawdown (feet)	Type of data available
LJ-65-11-806	Longhorn Town U.D., Well No. 1	Layne-Texas Co.	1983	1,395	16,10	210	860 -1,380	EVGL	101	270.00	05/07/1983	P	1,001	54.00	D,I,Q
LJ-65-11-916	Harris County M.U.D. 21, Well No. 1	Layne-Texas Co.	1981	1,170	18,12	255	668 -1,150	EVGL	96	340.00	10/12/1981	P	1,500	83.00	D,Q,W
LJ-65-11-917	Memorial West U.D., Well No. 2	Alsay-Texas Corp.	1983	1,288	24,18	--	636 - 998	EVGL	98	282.30	05/26/1983	P	2,000	107.70	D,I,Q
LJ-65-11-918	Harris County M.U.D. 175, Phase One	Alsay-Texas Corp.	1983	1,316	24,18,14	422	550 -1,152	EVGL	91	280.00	10/17/1983	P	2,000	82.94	D,I,Q
LJ-65-12-109	Horsepen Bayou M.U.D., Well No. 1	Alsay-Pippin Corp.	1980	1,146	16,10	280	696 -1,136	EVGL	113	271.00	03/11/1980	P	1,000	62.00	D,E
LJ-65-12-519	City of Houston, Katy-Addicks, Well No. 10	Layne-Texas Co.	1979	1,200	24,18,14	290	634 -1,184	EVGL	102	343.00	01/04/1980	P	2,539	86.00	D,E,Q,W
LJ-65-12-520	City of Houston, Katy-Addicks, Well No. 9	Layne-Texas Co.	1980	1,530	24,18,14	345	833 -1,512	EVGL	103	371.70	06/11/1980	P	2,513	119.00	D,E,Q,W
LJ-65-12-626	Spring Branch I.S.D.	--	--	560	6,4	--	--	CHCT	80	239.00	10/14/1963	P	--	--	--
LJ-65-12-730	City of Houston, Katy-Addicks, Well No. 11	Alsay-Texas Corp.	1983	1,712	24,18,14	575	685 -1,692	EVGL	85	358.45	01/17/1984	P	2,500	103.00	D,I,Q,W
LJ-65-12-731	Harris County M.U.D. 223, Well No. 1	Layne-Texas Co.	1983	1,190	24,18	328	517 -1,170	CHCT, EVGL	87	295.00	11/07/1983	P	1,918	91.00	D,Q
LJ-65-12-817	City of Houston, District 71, Well No. 3	Layne-Western Co., Inc.	1979	967	18,12	224	597 - 957	EVGL	80	260.00	05/01/1979	P	1,557	130.00	D,E,W
LJ-65-12-939	Memorial Villages Water Authority, Well No. 5 3 MI	Layne-Western Co., Inc.	1981	1,620	20,12	301	810 -1,610	EVGL	74	420.00	04/ /1981	P	2,089	100.00	D
LJ-65-13-322	City of Houston, Heights, Well No. 15-A	Layne-Texas Co.	1981	1,675	24,18,14	468	682 -1,665	EVGL	78	395.00	05/26/1981	P	2,513	73.00	D,E,Q,W
LJ-65-13-626	City of Houston, Heights, Well No. 6	Layne-Western Co., Inc.	1982	1,455	24,18,14	419	665 -1,440	EVGL	68	400.00	06/ /1982	P	2,000	56.00	D,W
LJ-65-13-627	City of Houston, Heights, Well No. 7-A	Layne-Western Co., Inc.	1979	1,465	24,18,14	424	702 -1,454	EVGL	69	360.00	11/30/1981	P	2,100	68.00	--
LJ-65-13-748	Houston Country Club, Well No. 2 3MI	Layne-Texas Co.	1980	1,197	20,14,10	145	955 -1,185	EVGL	65	385.00	12/09/1980	I	1,200	40.00	D,E,Q
LJ-65-13-749	Memorial Villages Water Authority, Well No. 6 4MI	Alsay-Texas Corp.	1983	1,526	20,14	380	786 -1,506	EVGL	71	392.40	02/10/1984	P	2,006	53.00	D,I,M,Q
LJ-65-14-732	National Vinegar Company	Hildebrandt Well Service	1968	506	4	20	486 - 506	CHCT	50	200.00	07/20/1968	N	--	--	--

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Table 1.--Records of Wells in Harris County--Continued

Well	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Screen Length (feet)	Screen Depth interval (feet)	Water-bearing unit	Altitude of land surface (feet)	Water level Below land surface datum (feet)	Water level Date of measurement	Use of water	Discharge (gallons per minute)	Drawdown (feet)	Type of data available
LJ-65-20-225	City of Houston, District 71, Well No. 1	Layne-Western Co., Inc.	1972	1,356	18,12	200	1,054 -1,350	EVGL	80	364.00	08/01/1978	P	1,500	80.00	D,E,Q,W
LJ-65-20-226	Harris County M.U.D. 51, Well No. 2 4MI	Layne-Western Co., Inc.	1979	1,610	20,12	287	1,144 -1,600	EVGL	80	--	--	P	--	--	D,Q
LJ-65-20-323	Cornelius Nurseries, Inc.	Raymond Water Wells	1983	295	5,2	30	250 - 290	CHCT	70	180.00	06/16/1983	C	32	15.00	D
LJ-65-20-415	2MI Bissonnet M.U.D., Water Plant 2, Well No. 1	Layne-Texas Co.	1983	1,525	20,14	325	1,059 -1,510	EVGL	89	345.00	08/30/1983	P	2,611	84.00	D,I,Q
LJ-65-20-625	Memorial Hospital Southwest, Well No. 1 3MI	Layne-Western Co., Inc.	1982	1,240	16,10	--	735 -1,225	EVGL	72	348.00	02/25/1982	P	1,016	31.00	D
LJ-65-20-626	City of Houston, Sharpstown, Well No. 3-A 2MI	Alsay-Texas Corp.	1981	1,550	24,18,14	324	920 -1,530	EVGL	70	393.31	09/25/1981	P	2,000	79.00	D,E,Q
LJ-65-20-912	Southwest Harris County M.U.D. 1, Well No. 1	Layne-Texas Co.	1980	772	10,6	115	550 - 760	CHCT, EVGL	65	262.00	06/02/1980	P	542	38.00	D,E,Q
LJ-65-21-147	Texaco, Inc.	Raymond Water Wells	1981	475	6,4	30	438 - 468	CHCT	60	250.00	03/05/1981	N	96	2.00	D
LJ-65-21-148	City of Houston, Southwest, Well No. 3-A 2MI	Layne-Texas Co.	1981	1,505	24,18,14	425	699 -1,490	EVGL	64	392.00	05/05/1981	P	2,513	100.00	D,E,Q
LJ-65-21-149	City of Houston, Southwest, Well No. 4-A 2MI	Alsay-Texas Corp.	1982	1,518	24,18,14	501	690 -1,498	EVGL	69	416.00	06/06/1982	P	2,000	32.00	D,E,Q,W
LJ-65-21-150	City of Houston, Southwest, Well No. 3-SB 2MI	Layne-Texas Co.	1982	646	24,18	238	330 - 631	CHCT	64	260.00	04/28/1982	P	1,560	141.00	D,E,Q,W
LJ-65-21-226	Harris-Galveston Coastal Subsidence District, Southwest, Well No. 1	Layne-Texas Co.	1980	2,358	5	20	2,316 -2,336	EVGL	64	302.95	03/12/1980	U	--	--	E,I,J,N, Q,S,W
LJ-65-21-227	Harris-Galveston Coastal Subsidence District, Southwest, Well No. 3	Layne-Western Co., Inc.	1980	1,433	4,2	10	1,418 -1,428	EVGL	64	411.15	04/05/1980	U	--	--	D,Q,W
LJ-65-21-228	Harris-Galveston Coastal Subsidence District, Southwest, Well No. 5	Layne-Western Co., Inc.	1980	253	4,2	10	238 - 248	CHCT	64	177.67	04/09/1980	U	--	--	D,Q,W
LJ-65-21-229	Harris-Galveston Coastal Subsidence District, Southwest, Well No. 4	Layne-Western Co., Inc.	1980	627	4,2	10	612 - 622	CHCT	64	314.21	05/06/1980	U	--	--	D,Q,W
LJ-65-21-230	Harris-Galveston Coastal Subsidence District, Southwest, Well No. 2	Layne-Western Co., Inc.	1980	1,943	4,2	10	1,928 -1,938	EVGL	64	383.72	04/15/1980	U	--	--	D,Q,W
LJ-65-21-231	City of West University Place, Well No. 7	Layne-Western Co., Inc.	1980	1,360	20,12	264	780 -1,295	EVGL	58	380.00	04/ /1980	P	1,560	47	D

Table 1.--Records of Wells in Harris County

Water Levels and Drawdown : Reported water levels given in feet; measured water levels given in feet.
Use of Water : H, domestic; I, irrigation; N, industrial; P, public supply; R, recreational; T, institution; U, unused.
Water-Bearing Unit : CHCT, Chicot aquifer; EVGL, Evangeline aquifer; JSPR, Jasper aquifer.
Type of Data Available : C, caliper log; D, drillers' log (see table 2); E, electric log; I, induction log; J, gamma-ray; L, lateral log; M, microlateral log; N, neutron log; Q, chemical analysis (see table 4); S, sonic log; W, water-level measurements (see table 3).

Well	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Screen		Water-bearing unit	Altitude of land surface (feet)	Water level		Use of water	Discharge (gallons per minute)	Drawdown (feet)	Type of data available
						Length (feet)	Depth interval (feet)			Below land surface datum (feet)	Date of measurement				
LJ-60-52-808	Champion Land	Bussell and Son, Inc.	1980	360	6,4	30	330 - 360	EVGL	176	78.00	04/23/1980	P	--	--	D
LJ-60-52-901	Northwest Harris County M.U.D. 19, Well No. 2	Lanford Drilling Co., Inc.	1982	880	16,10	340	530 - 870	EVGL	160	191.48	03/22/1983	P	800	162.00	D,E,Q
LJ-60-57-908	Lindsey, C.M., Well No. 3	Layne-Texas Co.	1982	910	18,12	350	200 - 900	EVGL	234	147.00	03/06/1982	I	3,046	80.00	D,I
LJ-60-58-508	Boy's Country	Pomykal Drilling Co.	1979	355	6	36	319 - 355	EVGL	210	137.00	06/ /1979	H	600	--	D
LJ-60-58-603	Girl's Country	Pomykal Drilling Co.	1980	328	6,4	44	284 - 328	EVGL	225	117.00	11/03/1980	H	100	--	D
LJ-60-59-323	City of Tomball	Alsay-Pippin Corp.	1979	451	16,10	142	222 - 444	CHCT, EVGL	195	75.20	10/21/1980	P	503	25.00	D,E
LJ-60-59-901	Lance, Steve	Bufkin Water Well	1983	265	5,2	20	245 - 265	CHCT	163	90.00	05/05/1983	P	100	--	D
LJ-60-60-307	Five Oaks Subdivision, Well No. 1	O'Day Drilling Co., Inc.	1981	386	6,4	30	356 - 386	CHCT	145	113.00	11/02/1981	P	250	--	D
LJ-60-60-308	Five Oaks Subdivision, Well No. 2	O'Day Drilling Co., Inc.	1981	385	6,4	30	355 - 385	CHCT	145	113.00	11/10/1981	P	300	--	D
LJ-60-60-504	Glenloch Farms, Well No. 3	Raymond Water Wells	1979	363	6,4	37	296 - 363	CHCT	146	115.00	10/20/1979	I	--	--	D
LJ-60-60-603	Klein I.S.D.	Bussell and Son, Inc.	1980	502	8,6	60	372 - 502	CHCT, EVGL	141	146.00	05/08/1980	P	480	63.00	D
LJ-60-60-809	Charterwood M.U.D., Well No. 2	Layne-Texas Co.	1980	680	20,14	137	427 - 677	CHCT, EVGL	135	200.00	07/28/1980	P	1,012	55.00	E,Q
LJ-60-60-810	Louetta North P.U.D., Well No. 1	Layne-Western Co., Inc.	1984	1,210	20,14,12	190	623 -1,200	EVGL	138	309.00	07/ /1984	P	1,529	95.00	D
LJ-60-60-914	Bilma P.U.D., Well No. 1	Layne-Texas Co.	1981	1,115	16,10	210	690 -1,100	EVGL	120	252.00	06/24/1981	P	1,022	55.00	D,E,Q
LJ-60-60-915	Harris County M.U.D. 24, Well No. 2	Layne-Texas Co.	1982	1,105	16,10	170	830 -1,090	EVGL	135	266.00	12/09/1982	P	1,040	69.00	D,E,L,Q
LJ-60-61-409	Bridgestone M.U.D., Well No. 2	Water Resources of Texas	1980	632	20,14,12	200	280 - 622	CHCT, EVGL	140	169.00	08/04/1980	P	1,000	55.00	D,Q
LJ-60-61-719	Harris County M.U.D. 211, Well No. 1	Lanford Drilling Co., Inc.	1982	814	16,12	374	440 - 814	CHCT, EVGL	112	228.00	10/12/1982	P	1,212	113.00	D,E,Q

Well LJ-65-12-817
Owner: City of Houston, Water Control and Improvement District 71
Driller: Layne-Western Co., Inc.

	Thickness (feet)	Depth (feet)
Clay, sandy	23	23
Sand	19	42
Clay	10	52
Sand	9	61
Clay	12	73
Sand	43	116
Clay	24	140
Sand	6	146
Clay	9	155
Sand	3	158
Clay	75	233
Sand	30	263
Clay	40	303
Sand	20	323
Clay	47	370
Sand and rock	5	375
Clay	82	457
Sand and rock	12	469
Clay	21	490
Sand	7	497
Clay	14	511
Sand and rock	2	513
Clay	18	531
Sand and rock	5	536
Clay	9	545
Sand and rock	15	560
Clay	85	645
Sand	5	650
Clay	64	714
Sand and rock	5	719

Well LJ-65-12-817--Continued

	Thickness (feet)	Depth (feet)
Clay	11	730
Sand and rock	12	742
Clay	28	770
Sand and rock	17	787
Clay	23	810
Sand and hard rock	76	886
Clay	85	971

Well LJ-65-12-939 3MI
Owner: Memorial Villages Water Authority, Well No. 5
Driller: Layne-Western Co., Inc.

	Thickness (feet)	Depth (feet)
Unrecorded	40	40
Clay	9	49
Clay, sandy	13	62
Clay	18	80
Sand	15	95
Clay	31	126
Sand	10	136
Clay, sandy	21	157
Clay and sandy streaks	15	172
Clay	8	180
Clay, sandy	5	185
Clay and sandy streaks	23	208
Sand and clay streaks	62	270
Clay, hard and shale	17	287
Sand	5	292
Clay	20	312
Sand	17	329
Shale	20	349
Sand	9	358
Clay and sand streaks	14	372
Sand with clay streaks	39	411
Sand	9	420

Table 2.--Drillers' logs of wells in Harris County--Continued

	Thickness (feet)	Depth (feet)
Well LJ-65-12-939--Continued 3M1		
Clay and sand streaks	10	430
Sand and clay streaks	18	448
Clay	10	458
Sand and clay streaks	8	466
Sand	22	488
Clay	7	495
Sand	30	525
Clay	40	565
Sand	31	596
Clay	9	605
Sand	15	620
Clay	45	665
Sand	20	685
Clay	20	705
Sand and clay streaks	25	730
Clay	25	755
Clay and sand streaks	15	770
Sand	19	789
Clay	32	821
Sand	14	835
Clay	65	900
Shale, hard	60	960
Sand	20	980
Clay	9	989
Sand	46	1,035
Clay	5	1,040
Sand	13	1,053
Clay and sand streaks	12	1,065
Clay	6	1,071
Sand and clay	11	1,082
Sand	48	1,130
Clay	10	1,140

	Thickness (feet)	Depth (feet)
Well LJ-65-12-939--Continued 3M1		
Sand and hard streaks	23	1,163
Sand	18	1,181
Clay	9	1,190
Sand and clay streaks	30	1,220
Clay	94	1,314
Limestone	7	1,321
Sand and limestone	42	1,363
Clay	7	1,370
Sand with limestone streaks	30	1,400
Clay	5	1,405
Limestone, hard	85	1,490
Limestone and sand streaks	30	1,520
Sand	12	1,532
Limestone and sand streaks	63	1,595
Sand	14	1,609
Sand and limestone streaks	71	1,680
Clay and sand streaks	40	1,720
Limestone and sand	3	1,723
Sand and clay	11	1,734
Sand	68	1,802
Well LJ-65-13-322 Owner: City of Houston, Heights, Well No. 15A Driller: Layne-Texas Co.		
Unrecorded	28	28
Sand	7	35
Clay	48	83
Sand	49	132
Clay	7	139
Sand	71	210
Clay	38	248
Sand	11	259
Clay	26	285
Sand and shale	32	317

Table 2.--Drillers' logs of wells in Harris County--Continued

	Thickness (feet)	Depth (feet)
Well LJ-65-13-627--Continued		
Shale and hard sand streaks	94	228
Sand, red and shale	20	248
Sand and shale streaks	12	260
Shale and sand	48	308
Sand and gravel	7	315
Shale, hard and limestone	7	322
Sand and gravel	17	339
Shale and limestone	7	346
Sand	16	362
Shale, sandy	13	375
Sand	10	385
Shale and limestone	15	400
Sand and shale streaks	30	430
Shale and limestone	24	454
Shale, sandy	26	480
Shale and sand streaks	50	530
Shale	25	555
Clay, sandy	12	567
Sand and clay streaks	5	572
Sand, shale streaks and clay	58	630
Sand and shale streaks	19	649
Shale	3	652
Shale, sandy	6	658
Shale and sand streaks	3	661
Sand	4	665
Sand, shale and gravel	85	750
Sand and shale	29	779
Shale, sandy and limestone	32	811
Sand and shale streaks	31	842
Shale	16	858
Clay and sand	20	878
Limestone	6	884

	Thickness (feet)	Depth (feet)
Well LJ-65-13-627--Continued		
Clay, sandy	15	899
Shale, hard and limestone	16	915
Clay, sandy	23	938
Clay, sticky	65	1,003
Sand and limestone	15	1,018
Clay, limestone and shale	62	1,080
Limestone streaks and shale	130	1,210
Limestone	14	1,224
Sand and limestone streaks	76	1,300
Shale streaks and sandy clay	40	1,340
Sand	5	1,345
Clay	3	1,348
Sand	7	1,355
Limestone	3	1,358
Shale, sandy and limestone	37	1,395
Sand	10	1,405
Shale, sandy and limestone	5	1,410
Sand and sandy shale	8	1,418
Sand, shale and limestone	32	1,450
Shale and sand streaks	68	1,518
Sand	32	1,550

Well LJ-65-13-748 3M1
Owner: Houston Country Club, Well No. 2
Driller: Layne-Texas Co.

	Thickness (feet)	Depth (feet)
Topsoil	6	6
Clay	25	31
Clay, sandy	28	59
Clay	32	91
Sand	8	99
Clay	47	146
Sand	26	172
Sand and lime streaks	48	220
Lime	5	225

Table 2.--Drillers' logs of wells in Harris County--Continued

Well LJ-65-13-748--Continued 3M1

	Thickness (feet)	Depth (feet)
Sand	13	238
Lime, sticky	5	243
Sand and lime streaks	50	293
Shale, blue and red	10	303
Sand with lime and shale streaks	36	339
Lime with red shale and sand	14	353
Sand	5	358
Lime with red shale and sand	15	373
Sand and red shale	45	418
Shale, red	6	424
Sand and shale streaks	33	457
Sand and lime streaks	186	643
Sand and red shale with lime streaks	81	724
Sand and lime streaks	20	744
Lime and sand streaks	38	782
Sand	13	795
Shale, gray and blue with sand streaks	31	826
Shale, hard, red and blue	24	850
Shale, hard	63	913
Shale, sticky, brown and gray	39	952
Shale, sandy, gray and blue	37	989
Sand with lime and gray shale	33	1,022
Shale, gray and sand streaks	59	1,081
Sand and shale	162	1,243
Shale	19	1,262
Shale and sand streaks	33	1,295
Shale	61	1,356
Shale and sand	114	1,470
Sand and shale streaks	21	1,491
Shale	13	1,504

Well LJ-65-13-749 4M1
Owner: Memorial Villages Water Authority, Well No. 6
Driller: Alsay-Texas Corp.

	Thickness (feet)	Depth (feet)
Topsoil	2	2
Clay, red	13	15
Sand, white	49	64
Clay, red	18	82
Sand, white and clay	36	118
Clay, gray	7	125
Sand, white and black	35	160
Sand, white and clay	63	223
Sand and gray clay	32	255
Sand, white and black	45	300
Clay, gray	14	314
Sand and gravel	71	385
Clay, white	17	402
Sand and white clay traces	111	513
Clay and sand stringers	62	575
Sand, tan and white	50	625
Sand and clay stringers	105	730
Shale, gray	49	779
Sand, tan	71	850
Clay, tan-to-white	90	940
Sand, tan	30	970
Clay, white	24	994
Sand and shale stringers	200	1,194
Shale, gray and brown	181	1,375
Sand, tan	20	1,395
Shale, gray and brown	25	1,420
Sand, tan-to-gray	60	1,480
Shale and sand stringers	120	1,600

Table 2.--Drillers' logs of wells in Harris County--Continued

	Thickness (feet)	Depth (feet)
Well LJ-65-20-225--Continued		
Sand	88	1,265
Clay	50	1,315
Sand and rock	35	1,350
Clay	40	1,390
Sand	21	1,411
Clay	44	1,455
Sand	10	1,465
Shale	12	1,477
Sand and rock	7	1,484
Well LJ-65-20-226 Owner: Harris County Municipal Utility District 51, Well No. 2 Driller: Layne-Western Co., Inc.		
Clay	6	6
Sand and clay	59	65
Clay	105	170
Sand	165	335
Clay	25	360
Sand	62	422
Sand and clay strips	10	432
Sand	8	440
Clay	17	457
Sand	363	820
Shale	80	900
Sand and shale	100	1,000
Sand	20	1,020
Shale	30	1,050
Sand and shale strips	100	1,150
Clay	170	1,320
Sand and rock breaks	100	1,420
Clay	33	1,453
Shale and clay	34	1,487
Sand	6	1,493

	Thickness (feet)	Depth (feet)
Well LJ-65-20-226--Continued		
Shale	33	1,526
Sand and shale	45	1,571
Sand and rock	5	1,576
Shale and clay	4	1,580
Shale and sand	52	1,632
Sand and rock	26	1,658
Sand and shale	38	1,696
Shale and clay	54	1,750
Sand and clay	35	1,785
Clay	18	1,803
Well LJ-65-20-323 Owner: Cornelius Nurseries, Inc. Driller: Raymond Water Wells		
Clay, red and gray	120	120
Sand	95	215
Clay	5	220
Clay, red and gray	20	240
Sand	30	270
Clay	7	277
Sand	13	290
Clay	7	297
Well LJ-65-20-415 Owner: Bissonnet Municipal Utility District, Plant 2, Well No. 1 Driller: Layne-Texas Co.		
Topsoil	2	2
Clay	6	8
Sand	30	38
Clay and sand streaks	152	190
Shale	105	295
Sand and shale streaks	78	373
Shale, red and gray with sand streaks	72	445
Sand and shale streaks	35	480
Shale	15	495

Table 2.--Drillers' logs of wells in Harris County--Continued

	Thickness (feet)	Depth (feet)
Well LJ-65-20-415--Continued		
Sand	17	512
Shale and sand streaks	68	580
Shale with sand and lime streaks	34	614
Sand and shale streaks	51	665
Sand	11	676
Shale, sandy	41	717
Sand and lime	9	726
Shale, sandy	14	740
Sand	42	782
Shale, sandy and shale	27	809
Sand and hard lime streaks	72	881
Shale and sand streaks	65	946
Sand	5	951
Shale	101	1,052
Shale and sand streaks	43	1,095
Shale	10	1,105
Shale and sand streaks	25	1,130
Sand and shale streaks	20	1,150
Shale and sand streaks	20	1,170
Sand and shale streaks	51	1,221
Sand	35	1,256
Shale, sandy	37	1,293
Shale, sandy and sand	32	1,325
Sand	198	1,523
Shale	21	1,544
Shale, sandy	20	1,564
Shale	94	1,658
Shale and sand streaks	130	1,788
Shale and lime streaks	15	1,803
Well LJ-65-20-625 Owner: Memorial Hospital Southwest, Well No. 1 Driller: Layne-Western Co., Inc.		
Topsoil	20	20
Well LJ-65-20-625--Continued		
Clay	53	73
Sand	7	80
Clay	4	84
Sand and clay streaks	9	93
Clay	17	110
Sand	11	121
Clay and sand streaks	14	135
Clay	17	152
Sand and clay	13	165
Clay	31	196
Sand	5	201
Clay and sand streaks	8	209
Sand	10	219
Clay	41	260
Sand	12	272
Clay	8	280
Sand	6	286
Clay and sand streaks	22	308
Sand	8	316
Clay	4	320
Sand	5	325
Clay and sand streaks	4	329
Sand	9	338
Clay	12	350
Sand	5	355
Clay and sand streaks	5	360
Clay	33	393
Sand	4	397
Clay	22	419
Sand	18	437
Clay and sand streaks	11	448

Table 2.--Drillers' logs of wells in Harris County--Continued

	Thickness (feet)	Depth (feet)
Well LJ-65-20-625--Continued		
Sand	23	471
Clay	50	521
Sand	12	533
Shale and sand streaks	28	561
Sand and clay streaks	48	609
Clay	22	631
Sand	7	638
Shale	3	641
Clay	6	647
Sand	3	650
Clay	10	660
Sand	11	671
Clay	27	698
Sand	28	726
Shale	32	758
Sand	45	803
Shale	30	833
Sand	12	845
Shale	40	885
Sand	10	895
Shale	16	911
Sand	58	969
Shale	181	1,150
Shale, sandy	45	1,195
Sand	35	1,230
Shale	55	1,285
Well LJ-65-20-626 Owner: City of Houston, Sharpstown, Well No. 3A Driller: Alsay-Texas Corp.		
Topsoil	3	3
Sand	35	38
Clay, light blue	20	58
Clay, red	18	76
Well LJ-65-20-626--Continued		
Sand	7	83
Clay, gray	10	93
Clay, red	30	123
Clay, gray	78	201
Sand	10	211
Clay, gray	17	228
Sand	30	258
Clay, gray	20	278
Sand	15	293
Clay, gray, sandy	20	313
Sand	45	358
Clay, gray, sandy	23	381
Clay, gray	17	398
Sand	30	428
Clay, gray	45	473
Sand	20	493
Clay, gray, sandy	10	503
Sandstone, hard	3	506
Shale, gray	10	516
Sand	45	561
Shale, gray	53	614
Sand	39	653
Shale	38	691
Sand	12	703
Shale, gray	30	733
Sand	30	763
Shale	75	838
Sand	10	848
Shale, gray	63	911
Sand	38	949
Shale, gray	19	968
Sand	24	992

Table 2.--Drillers' logs of wells in Harris County--Continued

	Thickness (feet)	Depth (feet)
Well LJ-65-20-626--Continued		
Shale, gray	30	1,022
Sand	35	1,057
Shale, gray	68	1,125
Sandstone, hard	1	1,126
Sand	10	1,136
Shale, blue, sandy	16	1,152
Sand	8	1,160
Shale, gray	12	1,172
Sand	47	1,219
Shale, gray	28	1,247
Shale, gray, sandy	16	1,263
Sand	14	1,277
Shale, red, hard	84	1,361
Sand	43	1,404
Sand and shale streaks	54	1,458
Sand	66	1,524
Shale, gray	80	1,604
Sand, hard	16	1,620
Shale, gray	18	1,638
Well LJ-65-20-912 Owner: Southwest Harris County Municipal Utility District 1, Well No. 1 Driller: Layne-Texas Co.		
Clay and sand streaks	80	80
Sand	21	101
Clay, sandy and sand streaks	45	146
Clay, hard, sticky and sandy clay	59	205
Sand	8	213
Clay, sandy and sand streaks	23	236
Sand, broken	14	250
Sand and sandy clay	88	338
Shale, sandy	7	345
Shale	45	390
Sand	8	398

	Thickness (feet)	Depth (feet)
Well LJ-65-20-912--Continued		
Shale, sandy	37	435
Sand	27	462
Shale	9	471
Sand	23	494
Shale	12	506
Sand	23	529
Shale, sandy	31	560
Sand and gravel	45	605
Shale, sandy and sand streaks	65	670
Sand, broken	44	714
Shale, sandy	16	730
Sand and lime streaks	20	750
Shale, sandy	10	760
Well LJ-65-21-147 Owner: Texaco, Inc. Driller: Raymond Water Wells		
Clay	50	50
Sand	10	60
Clay	20	80
Sand	34	114
Clay	48	162
Sand	8	170
Sand, red and white	15	185
Sand	35	220
Clay, blue	30	250
Clay, gray	30	280
Shale	20	300
Clay, red and gray	54	354
Sand	16	370
Clay	25	395
Sand	15	410
Rock	1	411
Sand	9	420

Table 2.--Drillers' logs of wells in Harris County--Continued

	Thickness (feet)	Depth (feet)
Well LJ-65-21-147--Continued		
Clay, blue	20	440
Sand	28	468
Clay	7	475
Well LJ-65-21-148 Owner: City of Houston, Southwest, Well No. 3A Driller: Layne-Texas Co.		
Clay, sandy	20	20
Clay	102	122
Clay, sandy	22	144
Clay	22	166
Sand and clay streaks	149	315
Sand	71	386
Sand and gravel	27	413
Clay	24	437
Sand	39	476
Clay	13	489
Sand	14	503
Lime	8	511
Sand	23	534
Lime	4	538
Sand	7	545
Lime	4	549
Sand	32	581
Shale, sandy	84	665
Clay and sand	103	768
Shale, sandy	54	822
Shale	215	1,037
Clay, sandy	82	1,119
Sand, shale and shale streaks	66	1,185
Shale	13	1,198
Sand	41	1,239
Shale and sandy shale	119	1,358
Shale, sandy	32	1,390
Well LJ-65-21-148--Continued		
Shale	23	1,413
Shale, sandy	69	1,482
Clay	74	1,556
Sand and shale streaks	9	1,565
Clay, sandy	105	1,670
Shale	62	1,732
Shale and lime streaks	31	1,763
Shale	56	1,819
Lime	13	1,832
Shale, sandy	58	1,890
Sand and shale streaks	88	1,978
Shale	11	1,989
Sand	88	2,077
Shale and sand streaks	20	2,097
Shale, sandy	94	2,191
Shale	10	2,201
Well LJ-65-21-149 Owner: City of Houston, Southwest, Well No. 4A Driller: Alsay-Texas Corp.		
Unrecorded	240	240
Sand	5	245
Clay	20	265
Sand	25	290
Sand and clay	75	365
Sand and clay	35	400
Sand, gravel and clay	70	470
Clay	51	521
Sand	29	550
Sand and clay	80	630
Clay, yellow	20	650
Sand	26	676
Clay	16	692
Sand	6	698

Table 2.--Drillers' logs of wells in Harris County--Continued

	Thickness (feet)	Depth (feet)
Well LJ-65-21-149--Continued		
Clay	7	705
Clay streaks	44	749
Clay	66	815
Clay and sand	25	840
Clay and sand streaks	20	860
Sand and shale	61	921
Sand and clay	127	1,048
Clay and sand streaks	71	1,119
Sand	44	1,163
Clay	18	1,181
Sand	67	1,248
Clay	30	1,278
Sand	46	1,324
Clay, hard	16	1,340
Clay	28	1,368
Clay and sand streaks	21	1,389
Clay	40	1,429
Sand streaks	69	1,498
Clay	17	1,515

Well LJ-65-21-150
Owner: City of Houston, Southwest, Well No. 3SB
Driller: Layne-Texas Co.

	Thickness (feet)	Depth (feet)
Topsoil	1	1
Clay	9	10
Sand	5	15
Clay, sandy clay and caliche streaks	13	28
Clay	14	42
Sand	6	48
Clay	16	64
Sand	3	67
Clay streaks and sandy clay	14	81
Sand and clay streaks	5	86
Clay and sandy clay	19	105
Well LJ-65-21-150--Continued		
Sand and clay	4	109
Clay and caliche streaks	8	117
Clay, red and sand streaks	16	133
Clay, gray and caliche	10	143
Sand and clay streaks	5	148
Shale	15	163
Sand and shale streaks	5	168
Shale	7	175
Clay, sandy and sand	3	178
Gravel and sand	21	199
Clay	5	204
Shale	5	209
Sand	5	214
Shale and clay	22	236
Shale streaks and caliche	3	239
Caliche	45	284
Sand and caliche	3	287
Clay and shale	15	302
Clay	20	322
Sand and clay streaks	64	386
Sand, gravel and clay streaks	10	396
Lime, hard	1	397
Sand and fine gravel	10	407
Sand streaks, hard with gravel and clay	7	414
Sand	10	424
Sand, clay and lime streaks	3	427
Sand streaks, hard with gravel and clay streaks	9	436
Sand streaks, fine with clay and lime	37	473
Sand, fine with clay and lime	6	479
Clay and lime	11	490
Sand and clay streaks	6	496
Clay	25	521

Table 2.--Drillers' logs of wells in Harris County--Continued

	Thickness (feet)	Depth (feet)
Well LJ-65-21-150--Continued		
Sand and clay streaks	11	532
Clay	2	534
Sand	16	550
Clay and lime streaks	5	555
Sand	7	562
Clay	5	567
Clay and sand	2	569
Sand	13	582
Clay, sand and lime	4	586
Sand and clay streaks	7	593
Clay and lime streaks	2	595
Sand and clay streaks	7	602
Sand, clay and lime streaks	5	607
Sand	6	613
Clay	8	621
Sand and clay streaks	10	631
Clay	14	645
Well LJ-65-21-227 Owner: Harris-Galveston Coastal Subsidence District, Southwest, Well No. 3 Driller: Layne-Western Co., Inc.		
Topsoil	2	2
Clay	28	30
Sand	35	65
Clay	25	90
Sand	40	130
Clay	80	210
Sand	50	260
Clay	15	275
Sand	25	300
Clay	38	338
Sand	77	415
Clay	10	425
Well LJ-65-21-227--Continued		
Sand	165	590
Clay	25	615
Sand	85	700
Clay	50	750
Sand	50	800
Clay	20	820
Sand	140	960
Clay	30	990
Sand	30	1,020
Clay	70	1,090
Sand	70	1,160
Clay	30	1,190
Sand	20	1,210
Clay	130	1,340
Sand	15	1,355
Clay	55	1,410
Sand	23	1,433
Well LJ-65-21-228 Owner: Harris-Galveston Coastal Subsidence District, Southwest, Well No. 5 Driller: Layne-Western Co., Inc.		
Topsoil	3	3
Clay	28	31
Sand	34	65
Clay	25	90
Sand	38	128
Clay	82	210
Sand	43	253
Well LJ-65-21-229 Owner: Harris-Galveston Coastal Subsidence District, Southwest, Well No. 4 Driller: Layne-Western Co., Inc.		
Topsoil	2	2
Clay	29	31
Sand	34	65

Table 3.--Water levels in wells in Harris County--Continued

WELL LJ-65-12-728--Cont.

Date	Water level
12/05/1983	144.01
01/04/1984	146.26
01/31/1984	145.36
02/28/1984	144.22
03/27/1984	145.73
04/24/1984	145.55
05/22/1984	145.14
06/19/1984	145.00
07/17/1984	146.48
08/14/1984	145.93
09/11/1984	146.83
10/10/1984	145.67
11/06/1984	144.82
12/05/1984	147.50

WELL LJ-65-12-729
OWNER: U.S. GEOLOGICAL SURVEY
SCREEN: 231-237 FEET
ELEVATION: 93 FEET

Date	Water level
01/02/1980	147.09
02/05/1980	146.54
03/04/1980	146.17
04/01/1980	146.25
04/29/1980	146.49
05/27/1980	146.73
06/24/1980	147.26
07/23/1980	147.02
08/19/1980	147.45
09/16/1980	143.90
10/14/1980	144.52
11/10/1980	144.72
12/09/1980	144.58
01/06/1981	144.67
02/04/1981	148.97
03/04/1981	148.34
03/31/1981	148.64
04/29/1981	148.98
05/26/1981	148.55
06/22/1981	148.66
07/20/1981	149.33
08/18/1981	149.76
09/14/1981	149.40
10/13/1981	150.44
11/12/1981	150.62
12/09/1981	150.77
01/05/1982	150.53
02/03/1982	150.66
03/03/1982	150.33
03/30/1982	150.07
04/28/1982	150.15
05/25/1982	150.27
06/22/1982	150.30
07/20/1982	150.46
08/18/1982	152.04
09/14/1982	152.62

WELL LJ-65-12-729--Cont.

Date	Water level
10/14/1982	152.95
11/09/1982	153.03
12/07/1982	153.47
01/04/1983	152.93
02/01/1983	151.98
03/02/1983	150.76
03/29/1983	152.54
04/26/1983	152.13
05/24/1983	151.27
06/21/1983	150.19
07/19/1983	148.66
08/17/1983	148.29
09/14/1983	153.29
10/12/1983	153.80
11/08/1983	153.17
12/05/1983	153.17
01/04/1984	153.54
01/31/1984	153.04
02/28/1984	152.67
03/27/1984	151.88
04/24/1984	151.74
05/22/1984	151.42
06/19/1984	151.88
07/17/1984	152.36
08/14/1984	152.05
09/11/1984	154.55
10/10/1984	153.64
11/06/1984	150.74
12/05/1984	133.69

WELL LJ-65-12-730
OWNER: CITY OF HOUSTON, KATY-ADDICKS, WELL NO. 11
SCREEN: 685-1,692 FEET
ELEVATION: 85 FEET

Date	Water level
01/17/1984	334.30

WELL LJ-65-12-801
OWNER: LAKESIDE COUNTRY CLUB, WELL NO. 2
SCREEN: 280-467 FEET
ELEVATION: 75 FEET

Date	Water level
01/23/1980	163.99
07/03/1980	166.11
09/22/1980	172.53
01/07/1981	171.26
06/09/1981	167.18
09/02/1981	187.35
01/20/1982	179.97
09/09/1982	196.90
01/12/1983	175.82
01/17/1984	174.06

WELL LJ-65-12-806
OWNER: LAKESIDE COUNTRY CLUB, WELL NO. 3
SCREEN: 427-806 FEET
ELEVATION: 70 FEET

Date	Water level
01/23/1980	195.58
01/07/1981	188.08
06/09/1981	188.33
09/02/1981	198.44
01/20/1982	188.56
09/09/1982	200.94
01/12/1983	189.22
01/17/1984	187.86

WELL LJ-65-12-817
OWNER: CITY OF HOUSTON, DISTRICT 71, WELL NO. 3
SCREEN: 597-957 FEET
ELEVATION: 80 FEET

Date	Water level
03/31/1980	276.34

WELL LJ-65-12-904 4H1
OWNER: MEMORIAL VILLAGE, WELL NO. 1
SCREEN: 940-1,555 FEET
ELEVATION: 70 FEET

Date	Water level
01/19/1982	405.00
02/18/1982	404.00
03/17/1982	405.00
04/22/1982	405.00
05/19/1982	412.00
03/18/1983	407.00
05/12/1983	402.00
06/22/1983	405.00
07/21/1983	407.00
08/30/1983	411.00
09/20/1983	414.00

WELL LJ-65-12-917 3H1
OWNER: CITY OF HOUSTON, LAKEVIEW, WELL NO. 3
SCREEN: 333-489 FEET
ELEVATION: 72 FEET

Date	Water level
01/24/1980	198.50
07/07/1980	202.59
09/23/1980	208.31
01/07/1981	205.29
06/10/1981	204.67

WELL LJ-65-13-614
OWNER: CITY OF HOUSTON, HEIGHTS, WELL NO. 3
SCREEN: 514-1,037 FEET
ELEVATION: 68 FEET

Date	Water level
01/07/1980	353.75
02/20/1981	350.20
01/14/1982	355.88
01/10/1983	369.35
01/04/1984	339.60

WELL LJ-65-13-624
OWNER: CITY OF HOUSTON, HEIGHTS, WELL NO. 17
SCREEN: 620-1,720 FEET
ELEVATION: 67 FEET

Date	Water level
01/08/1980	421.00

WELL LJ-65-13-626
OWNER: CITY OF HOUSTON, HEIGHTS, WELL NO. 6A
SCREEN: 665-1,440 FEET
ELEVATION: 68 FEET

Date	Water level
01/10/1983	391.00
01/10/1984	386.00

WELL LJ-65-13-701
OWNER: CITY OF HOUSTON, AFTON OAKS
SCREEN: 680-1,645 FEET
ELEVATION: 72 FEET

Date	Water level
01/23/1980	390.26
01/20/1981	392.50
01/18/1982	415.50
01/31/1983	396.50
01/12/1984	369.35

WELL LJ-65-13-716 3M1
OWNER: HOUSTON COUNTRY CLUB
SCREEN: 520-1,144 FEET
ELEVATION: 63 FEET

Date	Water level
01/29/1980	372.35
07/07/1980	373.20
09/23/1980	389.82
02/10/1981	376.92
09/21/1981	391.66
01/22/1982	377.12
09/09/1982	399.18
01/12/1983	381.04
01/26/1984	378.19

WELL LJ-65-13-801
OWNER: RIVER OAKS COUNTRY CLUB, WELL NO. 2
SCREEN: 617-1,210 FEET
ELEVATION: 52 FEET

Date	Water level
01/30/1980	305.14
07/07/1980	318.05
09/23/1980	329.91
02/10/1981	325.41
06/10/1981	350.57
09/21/1981	344.23
01/22/1982	328.71
09/09/1982	349.22
01/12/1983	330.30
01/26/1984	327.17

WELL LJ-65-13-903
OWNER: CITY OF HOUSTON, CENTRAL, WELL NO. 19
SCREEN: 1,160-1,960 FEET
ELEVATION: 52 FEET

Date	Water level
01/04/1980	403.34
01/19/1982	415.28

WELL LJ-65-13-904
OWNER: CITY OF HOUSTON, CENTRAL, WELL NO. 20
SCREEN: 1,015-1,940 FEET
ELEVATION: 46 FEET

Date	Water level
01/08/1980	430.35
01/26/1981	410.90
01/21/1982	419.09
01/05/1983	421.75
01/09/1984	454.65

WELL LJ-65-13-905
OWNER: CITY OF HOUSTON, CENTRAL, WELL NO. 21
SCREEN: 745-2,000 FEET
ELEVATION: 43 FEET

Date	Water level
01/08/1980	383.80
01/26/1981	384.70
01/11/1983	388.00
01/10/1984	377.00

WELL LJ-65-13-927
OWNER: CITY OF HOUSTON, LINCOLN POOL
DEPTH: 625 FEET
ELEVATION: 45 FEET

Date	Water level
01/24/1980	255.15
02/21/1980	254.81
03/24/1980	252.23

WELL LJ-65-13-927--Cont.

Date	Water level
04/24/1980	253.98
05/23/1980	254.17
06/24/1980	253.06
07/24/1980	260.05
08/22/1980	258.20
09/24/1980	266.57
10/24/1980	265.13
11/24/1980	266.84
12/23/1980	265.43
01/23/1981	260.90
02/24/1981	262.33
03/24/1981	259.62
04/24/1981	260.55
05/22/1981	259.38
06/24/1981	261.07
07/24/1981	261.85
08/24/1981	263.02
09/24/1981	266.81
10/23/1981	267.75
12/01/1981	260.28
12/23/1981	257.15
01/22/1982	259.38
02/24/1982	258.56
03/24/1982	259.13
04/23/1982	259.16
05/24/1982	259.42
06/24/1982	260.75
07/23/1982	269.13
08/23/1982	274.42
09/24/1982	278.66
10/22/1982	274.98
11/24/1982	266.18
12/22/1982	259.87
01/24/1983	253.71
02/24/1983	250.07
03/24/1983	246.81
04/22/1983	247.44
05/23/1983	249.01
06/24/1983	254.31
07/22/1983	256.88
08/24/1983	254.13
09/23/1983	248.97
10/24/1983	245.02
11/25/1983	243.00
12/22/1983	239.11

WELL LJ-65-13-944
OWNER: CITY OF HOUSTON, CENTRAL, WELL NO. 22
SCREEN: 700-1,630 FEET
ELEVATION: 32 FEET

Date	Water level
01/07/1980	370.28
01/26/1981	392.17
01/21/1982	415.37
01/11/1983	401.70
01/09/1984	402.00

Table 3.--Water levels in wells in Harris County--Continued

WELL LJ-65-20-111--Cont.

Date	Water level
01/20/1983	183.68
01/19/1984	184.99

WELL LJ-65-20-203
OWNER: E.W. ANDRAU
SCREEN: 177-693 FEET
ELEVATION: 81 FEET

Date	Water level
03/07/1980	169.95
09/09/1980	182.13
09/18/1980	197.85
06/16/1981	202.71
09/25/1981	207.89
01/29/1982	204.98
09/15/1982	215.53
09/22/1982	213.88
01/20/1983	205.74
01/19/1984	206.65

WELL LJ-65-20-210
OWNER: CITY OF HOUSTON,
WALNUT BEND
SCREEN: 334-455 FEET
ELEVATION: 78 FEET

Date	Water level
01/28/1980	198.06
02/18/1981	211.57
01/29/1982	216.17
01/20/1983	219.23
01/19/1984	222.52

WELL LJ-65-20-216
OWNER: CITY OF HOUSTON,
LAKESIDE FOREST
SCREEN: 870-1,300 FEET
ELEVATION: 79 FEET

Date	Water level
01/28/1980	348.12
02/18/1981	365.50
01/29/1982	367.83
01/18/1983	369.72
01/19/1984	371.46

WELL LJ-65-20-218
OWNER: CITY OF HOUSTON,
WALNUT BEND,
WELL NO. 2
SCREEN: 660-1,265 FEET
ELEVATION: 79 FEET

Date	Water level
01/28/1980	305.40
02/10/1981	327.94
01/29/1982	328.25
01/18/1983	330.17
01/19/1984	332.59

WELL LJ-65-20-225
OWNER: CITY OF HOUSTON,
DISTRICT 71,
WELL NO. 1
SCREEN: 1,054-1,350 FEET
ELEVATION: 80 FEET

Date	Water Level
03/31/1980	356.02
09/15/1981	385.30
01/29/1982	382.09
09/22/1982	386.97
01/18/1983	382.06
01/26/1984	368.18

WELL LJ-65-20-301 1M1
OWNER: CITY OF HOUSTON,
SOUTHWEST, WELL NO. 6
SCREEN: 548-1,360 FEET
ELEVATION: 71 FEET

Date	Water Level
01/14/1980	386.00
01/14/1981	394.00
01/15/1982	398.00

WELL LJ-65-20-302 1M1
OWNER: CITY OF HOUSTON,
SOUTHWEST, WELL NO. 7
SCREEN: 490-1,440 FEET
ELEVATION: 71 FEET

Date	Water Level
01/14/1980	355.00
01/14/1981	372.00
01/08/1982	390.36
01/28/1983	406.08
01/06/1984	396.94

WELL LJ-65-20-303 1M1
OWNER: CITY OF HOUSTON,
SOUTHWEST, WELL NO. 8
SCREEN: 560-1,445 FEET
ELEVATION: 73 FEET

Date	Water Level
01/14/1980	337.25
01/16/1981	344.85
01/08/1982	352.01
01/31/1983	348.96
01/06/1984	346.20

WELL LJ-65-20-304 1M1
OWNER: CITY OF HOUSTON,
SOUTHWEST, WELL NO. 11
SCREEN: 755-1,552 FEET
ELEVATION: 74 FEET

Date	Water Level
01/15/1980	379.00
01/14/1981	390.00
01/15/1982	396.00

WELL LJ-65-20-307 1M1
OWNER: CITY OF HOUSTON,
DISTRICT 34,
WELL NO. 2
SCREEN: 624-881 FEET
ELEVATION: 74 FEET

Date	Water level
01/28/1980	327.49
06/26/1980	336.34
09/09/1980	346.10
09/18/1980	360.18
02/10/1981	343.79
06/16/1981	364.38
09/03/1981	334.74
01/28/1982	333.53
09/15/1982	370.45
01/19/1983	338.62
01/19/1984	341.26

WELL LJ-65-20-309 ZM1
OWNER: CITY OF HOUSTON,
DISTRICT 52,
WELL NO. 1
SCREEN: 586-896 FEET
ELEVATION: 75 FEET

Date	Water level
01/28/1980	321.26
02/10/1981	331.77
01/28/1982	334.11
01/18/1983	332.98
01/19/1984	335.13

WELL LJ-65-20-319 1M1
OWNER: CITY OF HOUSTON,
DISTRICT 54,
WELL NO. 2
SCREEN: 630-1,370 FEET
ELEVATION: 72 FEET

Date	Water level
01/28/1980	391.25
01/16/1981	405.23
01/19/1982	422.42
01/26/1983	428.03
02/03/1984	391.92

WELL LJ-65-20-322 ZM1
OWNER: CITY OF HOUSTON,
WINDSWEPT,
WELL NO. 1
SCREEN: 658-1,520 FEET
ELEVATION: 75 FEET

Date	Water level
01/28/1980	366.49
02/18/1981	379.00
01/19/1983	394.26
02/13/1984	387.81

WELL LJ-65-20-405
OWNER: CITY OF HOUSTON, BELLAIRE-BRAYS, WELL NO. 1
SCREEN: 640-1,620 FEET
ELEVATION: 81 FEET

Date	Water level
02/20/1980	280.71
01/06/1981	298.52
01/06/1982	290.70
01/21/1983	294.67
02/01/1984	299.12

WELL LJ-65-20-407
OWNER: CITY OF HOUSTON, BELLAIRE-BRAYS, WELL NO. 4
SCREEN: 618-1,634 FEET
ELEVATION: 85 FEET

Date	Water level
02/20/1980	295.56
01/06/1981	288.39
01/04/1982	282.31
01/21/1983	284.59
02/01/1984	293.62

WELL LJ-65-20-408
OWNER: CITY OF HOUSTON, BELLAIRE-BRAYS, WELL NO. 5
SCREEN: 639-1,583 FEET
ELEVATION: 85 FEET

Date	Water level
02/20/1980	316.40
01/06/1981	316.18
01/21/1983	319.10
02/03/1984	328.72

WELL LJ-65-20-409
OWNER: CITY OF HOUSTON, BELLAIRE-BRAYS, WELL NO. 3
SCREEN: 609-1,551 FEET
ELEVATION: 75 FEET

Date	Water level
02/20/1980	275.13
01/06/1981	292.25
01/06/1982	292.70
01/21/1983	295.67
02/03/1984	303.52

WELL LJ-65-20-507 4M1
OWNER: WESTWOOD COUNTRY CLUB
SCREEN: 895-1,044 FEET
ELEVATION: 71 FEET

Date	Water level
01/26/1982	263.50
02/18/1982	267.50
03/17/1982	265.50

WELL LJ-65-20-507--Cont.

Date	Water Level
04/22/1982	262.50
05/19/1982	275.50
06/17/1982	270.00
07/21/1982	278.00
09/20/1982	288.00
12/22/1982	265.00
01/11/1983	272.00
03/03/1983	270.00
03/17/1983	263.00
05/12/1983	264.00
06/22/1983	269.00
07/21/1983	271.00
08/30/1983	274.00
09/20/1983	278.00
10/21/1983	273.00
11/09/1983	270.00

WELL LJ-65-20-513
OWNER: CITY OF HOUSTON, BELLAIRE-BRAYS, WELL NO. 2
SCREEN: 649-1,631 FEET
ELEVATION: 75 FEET

Date	Water Level
02/20/1980	297.09
01/06/1981	310.86
01/04/1982	307.19
01/21/1983	309.10
02/01/1984	320.16

WELL LJ-65-20-602 2M1
OWNER: CITY OF HOUSTON, SHARPSTOWN, WELL NO. 1
SCREEN: 595-950 FEET
ELEVATION: 70 FEET

Date	Water Level
01/14/1980	308.50
06/26/1980	305.50
09/18/1980	326.50
02/13/1981	314.50
09/18/1981	330.50
01/28/1982	316.50
09/15/1982	333.50
01/19/1983	318.50
01/26/1984	316.00

WELL LJ-65-20-603 2M1
OWNER: CITY OF HOUSTON, SHARPSTOWN, WELL NO. 2
SCREEN: 584-989 FEET
ELEVATION: 76 FEET

Date	Water Level
01/14/1980	303.80
02/13/1981	310.09
01/28/1982	312.68
09/22/1982	317.43
01/19/1983	314.05
01/26/1984	311.92

WELL LJ-65-20-608 2M1
OWNER: CITY OF HOUSTON, SHARPSTOWN, WELL NO. 3
SCREEN: 605-1,520 FEET
ELEVATION: 70 FEET

Date	Water level
01/14/1980	305.27
01/07/1981	316.94

WELL LJ-65-20-614 2M1
OWNER: CITY OF HOUSTON, SHARPSTOWN, WELL NO. 4
SCREEN: 579-1,495 FEET
ELEVATION: 76 FEET

Date	Water level
01/14/1980	327.19
01/07/1981	337.20
01/19/1982	347.82
01/26/1983	351.23
02/03/1984	361.70

WELL LJ-65-20-617 4M1
OWNER: CITY OF HOUSTON, BRAEBURN VALLEY, WELL NO. 1
SCREEN: 490-700 FEET
ELEVATION: 68 FEET

Date	Water level
02/05/1980	257.45
06/26/1980	265.00
09/25/1980	274.13
01/08/1981	276.64
06/15/1981	286.63
09/18/1981	291.70
01/28/1982	290.46
09/17/1982	299.38
01/17/1983	290.29
01/26/1984	288.11

WELL LJ-65-20-618 4M1
OWNER: CITY OF HOUSTON, BRAEBURN VALLEY, WELL NO. 2
SCREEN: 885-1,325 FEET
ELEVATION: 70 FEET

Date	Water level
02/20/1980	318.00
02/12/1981	328.60
09/25/1981	341.11
01/28/1982	336.74
09/15/1982	353.66
01/17/1983	338.85
01/26/1984	335.50

Table 3.--Water levels in wells in Harris County--Continued

WELL LJ-65-20-619
OWNER: CITY OF HOUSTON,
BRAESWOOD, WELL NO. 1
SCREEN: 690-1,755 FEET
ELEVATION: 60 FEET

Date	Water level
02/07/1980	323.87
01/07/1981	350.82
01/07/1982	339.41
01/05/1983	346.26

WELL LJ-65-20-908
OWNER: CITY OF HOUSTON,
BRAEBURN WEST
SCREEN: 627-908 FEET
ELEVATION: 73 FEET

Date	Water level
02/05/1980	273.79
06/26/1980	276.76
01/08/1981	288.60
06/16/1981	302.15
09/02/1981	335.23
01/28/1982	332.10
09/15/1982	343.86
01/17/1983	329.94
01/26/1984	327.74

WELL LJ-65-20-910
OWNER: CITY OF HOUSTON,
SIMS BAYOU,
WELL NO. 5
SCREEN: 610-1,188 FEET
ELEVATION: 70 FEET

Date	Water level
01/29/1980	271.25
01/12/1981	283.45
01/19/1982	301.66
01/07/1983	302.42
01/17/1984	302.25

WELL LJ-65-20-911
OWNER: CITY OF HOUSTON,
SIMS BAYOU,
WELL NO. 4
SCREEN: 645-1,185 FEET
ELEVATION: 70 FEET

Date	Water level
01/29/1980	273.72
01/12/1981	283.89
01/19/1982	303.72
01/07/1983	302.53
01/16/1984	300.11

WELL LJ-65-21-102 3MI
OWNER: CITY OF HOUSTON,
SOUTHWEST, WELL NO. 2
SCREEN: 657-1,473 FEET
ELEVATION: 64 FEET

Date	Water level
01/22/1981	415.72

WELL LJ-65-21-102--Cont.

Date	Water level
01/11/1982	427.77

WELL LJ-65-21-104 ZMI
OWNER: CITY OF HOUSTON,
SOUTHWEST, WELL NO. 4
SCREEN: 692-1,490 FEET
ELEVATION: 66 FEET

Date	Water level
01/14/1980	381.00

WELL LJ-65-21-143 4MI
OWNER: CITY OF HOUSTON,
SOUTHWEST, WELL NO. 1A
SCREEN: 716-1,492 FEET
ELEVATION: 64 FEET

Date	Water level
01/15/1980	402.94
01/16/1981	414.18
01/11/1982	436.04
01/25/1983	405.54
01/05/1984	382.59

WELL LJ-65-21-144 ZMI
OWNER: CITY OF HOUSTON,
SOUTHWEST, WELL NO. 5
SCREEN: 652-1,380 FEET
ELEVATION: 69 FEET

Date	Water level
01/15/1980	398.00
01/16/1981	416.00
01/11/1982	428.11
01/28/1983	397.14
01/06/1984	397.94

WELL LJ-65-21-149 ZMI
OWNER: CITY OF HOUSTON,
SOUTHWEST, WELL NO. 4A
SCREEN: 690-1,498 FEET
ELEVATION: 69 FEET

Date	Water level
01/09/1984	407.00

WELL LJ-65-21-150 ZMI
OWNER: CITY OF HOUSTON,
SOUTHWEST, WELL NO. 3SB
SCREEN: 330-631 FEET
ELEVATION: 64 FEET

Date	Water level
01/16/1984	339.00

WELL LJ-65-21-201
OWNER: CITY OF HOUSTON,
SOUTHWEST, WELL NO. 9
SCREEN: 554-1,031 F
ELEVATION: 63 FEET

Date	Water level
01/14/1980	311.84
01/16/1981	317.48
01/08/1982	329.52
01/24/1983	321.26
01/05/1984	311.95

WELL LJ-65-21-226
OWNER: HARRIS-GALVESTON
COASTAL SUBSIDENCE
DISTRICT, SOUTHWEST,
WELL NO. 1
SCREEN: 2,316-2,336 FEET
ELEVATION: 64 FEET

Date	Water level
02/13/1980	308.28
02/21/1980	299.70
03/12/1980	303.10
04/10/1980	304.77
05/06/1980	305.07
05/28/1980	305.16
06/24/1980	303.89
07/23/1980	304.10
08/19/1980	305.42
09/16/1980	301.45
10/14/1980	300.97
11/10/1980	297.47
12/09/1980	295.37
01/06/1981	294.91
02/05/1981	294.30
03/05/1981	301.65
03/31/1981	304.35
04/28/1981	302.43
05/26/1981	302.71
06/22/1981	303.06
07/20/1981	310.08
08/18/1981	310.44
09/15/1981	310.72
10/13/1981	311.32
11/13/1981	313.23
12/08/1981	313.64
01/06/1982	312.61
02/02/1982	312.85
03/03/1982	313.14
03/30/1982	313.42
04/28/1982	313.88
05/25/1982	313.94
06/22/1982	313.92
07/20/1982	314.05
08/17/1982	314.57
09/14/1982	315.39
10/14/1982	315.94
11/09/1982	317.02
12/07/1982	317.56
01/04/1983	318.48
02/01/1983	318.62
03/02/1983	318.47

Table 3.--Water levels in wells in Harris County--Continued

WELL LJ-65-21-402 4M1
OWNER: CITY OF BELLAIRE,
WELL NO. 3
SCREEN: 1,200-1,570 FEET
ELEVATION: 59 FEET

Date	Water level
01/31/1980	397

WELL LJ-65-21-403
OWNER: CITY OF HOUSTON,
MEYERLAND, WELL NO. 1
SCREEN: 710-1,770 FEET
ELEVATION: 56 FEET

Date	Water level
01/25/1980	324
01/07/1981	311
01/07/1982	372
01/05/1983	368

WELL LJ-65-21-404
OWNER: CITY OF HOUSTON,
MEYERLAND, WELL NO. 22
SCREEN: 618-1,198 FEET
ELEVATION: 61 FEET

Date	Water level
01/25/1980	268
01/07/1981	320.04
01/04/1982	315.93
01/05/1983	318.77
01/06/1984	316.14

WELL LJ-65-21-413
OWNER: CITY OF BELLAIRE,
WELL NO. 1
SCREEN: 651-708 FEET
ELEVATION: 59 FEET

Date	Water level
01/14/1980	298.49
06/26/1980	300.09
09/18/1980	315.04
02/12/1981	298.30
06/16/1981	300.93
09/18/1981	316.26
01/22/1982	299.42
09/15/1982	321.17
01/18/1983	300.38
01/26/1984	298.89

WELL LJ-65-21-414 4M1
OWNER: CITY OF HOUSTON,
BRAESWOOD, WELL NO. 2
SCREEN: 620-1,735 FEET
ELEVATION: 66 FEET

Date	Water level
02/07/1980	342.29
01/07/1981	330.88
01/07/1982	355.83
01/05/1983	349.60
01/05/1984	343.26

WELL LJ-65-21-503
OWNER: CITY OF HOUSTON,
LINKWOOD, WELL NO. 1
SCREEN: 770-1,840 FEET
ELEVATION: 52 FEET

Date	Water Level
01/10/1980	337
01/23/1981	335
01/15/1982	341
01/04/1983	344
01/04/1984	342

WELL LJ-65-21-504
OWNER: CITY OF HOUSTON,
LINKWOOD, WELL NO. 2
SCREEN: 735-2,260 FEET
ELEVATION: 52 FEET

Date	Water Level
01/10/1980	369.03
01/16/1981	373.52
01/07/1982	368.70
01/04/1983	376.18
01/04/1984	372.91

WELL LJ-65-21-507
OWNER: CITY OF HOUSTON,
WILLOW MEADOWS
SCREEN: 557-799 FEET
ELEVATION: 60 FEET

Date	Water Level
06/26/1980	271.50
09/25/1980	289.02
02/12/1981	291.10
06/15/1981	299.01
09/18/1981	305.54
01/25/1982	304.83
09/17/1982	308.52
01/17/1983	302.11
01/26/1984	298.86

WELL LJ-65-21-509
OWNER: CITY OF HOUSTON,
LINKWOOD, WELL NO. 3
SCREEN: 725-1,860 FEET
ELEVATION: 51 FEET

Date	Water Level
01/14/1980	351.71
01/16/1981	358.95
01/19/1982	356
01/04/1983	360.04
01/04/1984	357.27

WELL LJ-65-21-703
OWNER: CITY OF HOUSTON,
WESTBURY
DEPTH: 271 FEET
ELEVATION: 66 FEET

Date	Water Level
01/25/1980	139.05
09/17/1980	152.17

WELL LJ-65-21-703--Cont.

Date	Water level
01/03/1983	137.93
01/05/1984	136.58

WELL LJ-65-21-707
OWNER: CITY OF HOUSTON,
WESTBURY, WELL NO. 3
SCREEN: 653-1,765 FEET
ELEVATION: 66 FEET

Date	Water level
01/25/1980	304.84
01/07/1981	329.56
01/03/1983	351.62

WELL LJ-65-21-708
OWNER: CITY OF HOUSTON,
SIMS BAYOU,
WELL NO. 3
SCREEN: 632-1,180 FEET
ELEVATION: 65 FEET

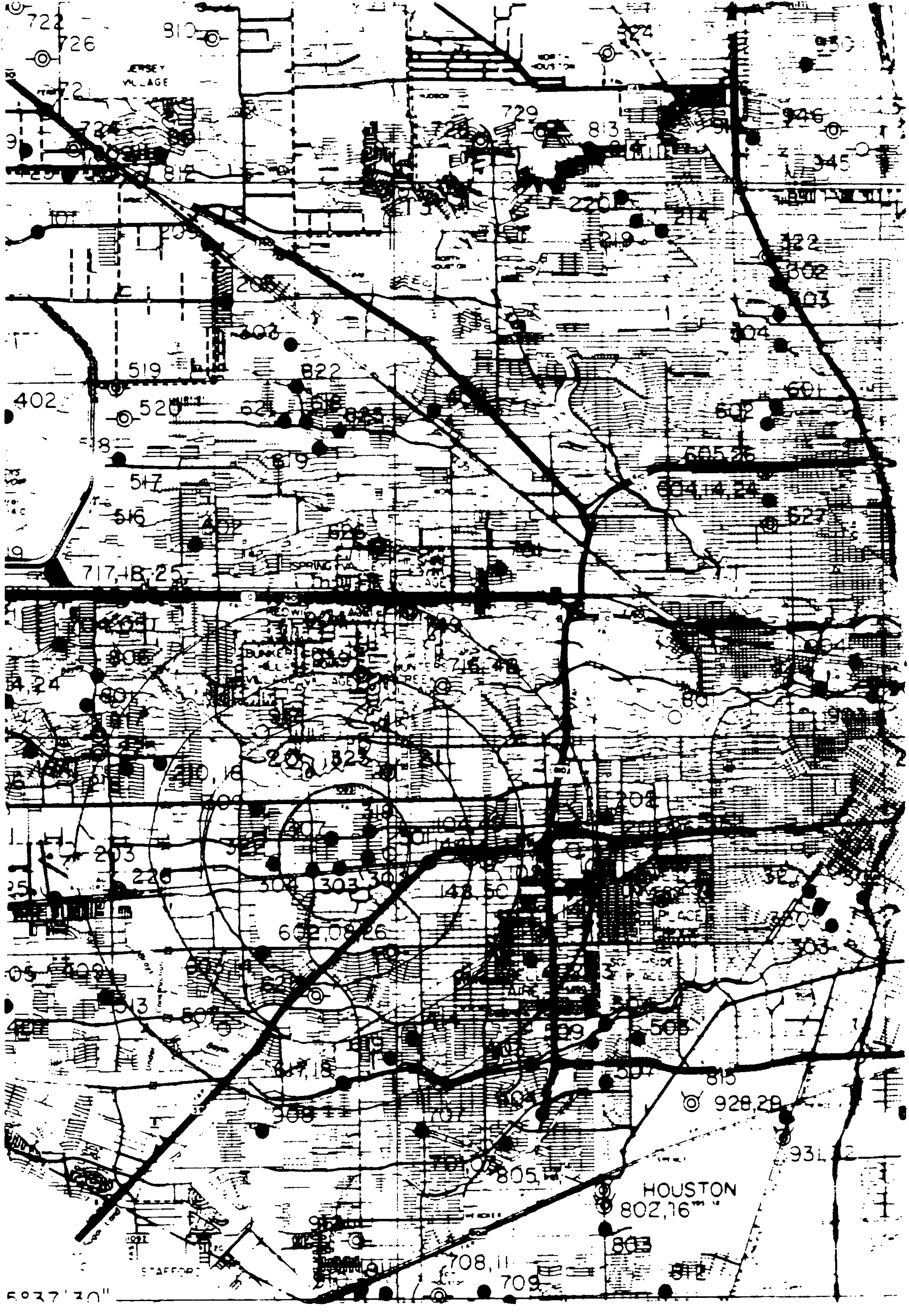
Date	Water level
01/30/1980	279.70
01/12/1981	286.05
01/19/1982	306.82
01/07/1983	309.29
01/16/1984	307.93

WELL LJ-65-21-709
OWNER: CITY OF HOUSTON,
SIMS BAYOU,
WELL NO. 2
SCREEN: 644-1,169 FEET
ELEVATION: 65 FEET

Date	Water level
01/30/1980	280.87
01/12/1981	293.82
01/19/1982	310.66
01/04/1983	312.17
01/16/1984	311.04

WELL LJ-65-21-802
OWNER: HOUSTON LIGHTING
AND POWER CO.,
HIRAM CLARK,
WELL NO. 2
SCREEN: 895-1,263 FEET
ELEVATION: 67 FEET

Date	Water level
01/03/1980	339
01/25/1980	334
09/29/1980	358
11/12/1980	351
12/08/1980	359
01/12/1981	351
02/10/1981	346
03/05/1981	347
04/03/1981	349
05/04/1981	351
06/15/1981	351
07/28/1981	352


722
726
810
JERSEY VILLAGE
729
813
946
345
220
219
519
822
402
520
517
516
717,18,25
605,26
604,14,24
627
716,48
210,18
203
226
602,08,26
513
617,18
308
815
928,29
HOUSTON
802,16
803
708,11
709
805
STAFFORD
$5°37'30"$

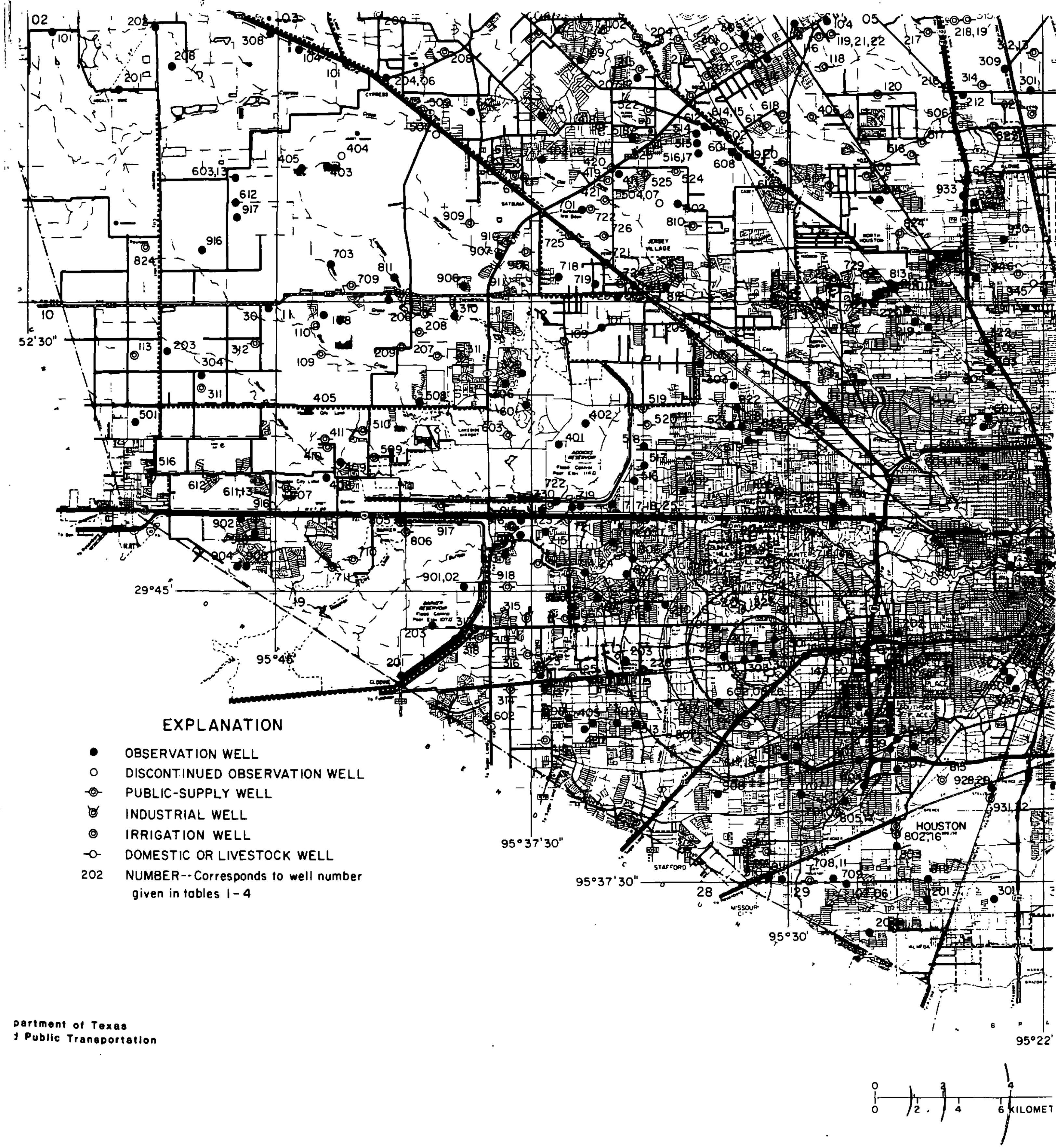
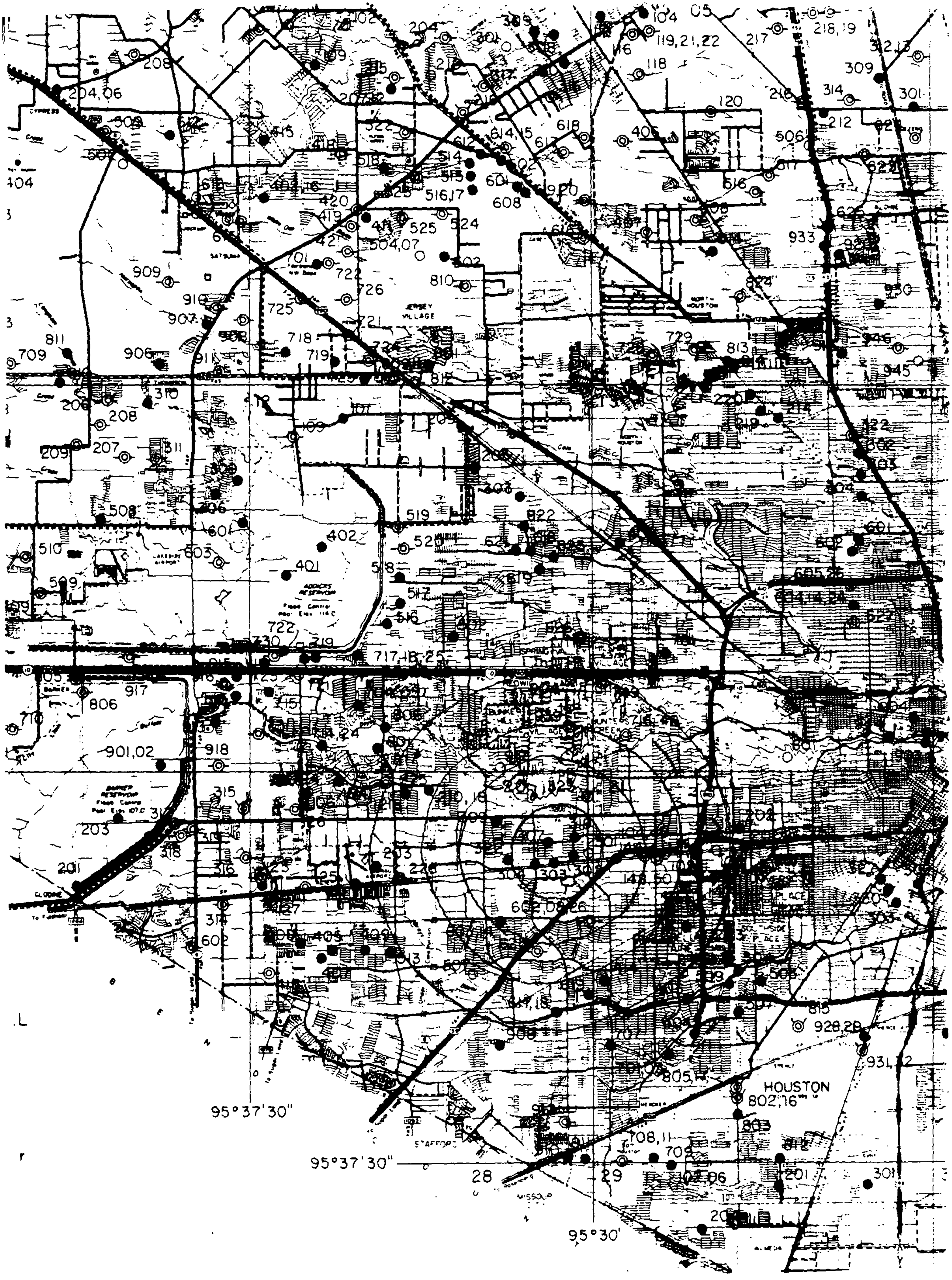


Figure 1.
Location of wells in Harris County.



JERSEY VILLAGE
ADDICKS RESERVOIR
BARKER RESERVOIR
SPRING VALLEY
HOUSTON
STAFFORD
95°37'30"
95°37'30"
95°30'
28
29

REFERENCE 21

SOIL SURVEY OF

Harris County, Texas

United States Department of Agriculture
Soil Conservation Service
In cooperation with the
Texas Agricultural Experiment Station and the
Harris County Flood Control District

Contents

Issued August 1976

Index to Soil Mapping Units

percent of the export tonnage of the Port of Houston is agricultural commodities.

The Lyndon B. Johnson Space Center is located in the southeastern part of Harris County, about 22 miles from downtown Houston. This complex was constructed in 1962 on a 1,640 acre site.

Transportation

Interstate Highway 10 and Interstate Highway 45 meet in Houston, and in addition to a freeway system, Harris County has an excellent network of state and farm-to-market highways.

The Port of Houston, which in 1972 moved more than 69 million tons of cargo, is the third largest seaport in the United States in total tonnage, according to official statistics of the U.S. Corps of Engineers. The Houston Ship Channel, a 50-mile inland waterway, connects Houston with the sea lanes of the world. Most of the channel has a minimum width of 400 feet and a depth of 40 feet.

More than 100 steamship lines offer regular service between the Port of Houston and some 250 ports of the world. Every year more than 4,000 ships call at Houston, which has more than 100 wharves in operation.

Six major rail systems operate 14 lines of mainline track radiating from the City of Houston, and two switching lines serve the industrial areas and the Port of Houston.

Natural Resources

Harris County has abundant supplies of minerals, timber, farming soil, sea water, and fresh water. Oil and gas furnish hydrocarbon compounds for refineries and chemical-petrochemical industries. Forest products from Harris County and surrounding counties support lumbering, plywood production, furniture fabrication, and paper milling. Salt and lime are also produced in the county.

The southeastern part of Harris County joins Galveston Bay for an abundant supply of sea water. The county is located atop a great underground water reservoir. A recent study indicates that the water in storage in the underground aquifer is sufficient for 250 years at a withdrawal rate of 600 million gallons daily. A dam on the San Jacinto River forms Lake Houston, which supplies Houston with 130 million gallons of surface water per day.

Climate

The climate of Harris County is predominantly marine. The terrain includes numerous small streams and bayous which, together with the nearness to Galveston Bay, favor the development of fogs. Prevailing winds are from the southeast and south, except in January when frequent high pressure areas bring invasions of polar air and prevailing northerly winds.

Temperatures are moderated by the influence of winds from the Gulf, which results in mild winters and relatively cool summer nights. Another effect of the nearness of the Gulf is abundant rainfall, except for rare extended dry periods. Polar air penetrates the area frequently enough to provide stimulating variability in the weather. Table 1 gives data on temperature and precipitation.

The average number of days with minimum temperatures of 32 degrees F. or lower is only about 7 per year at Houston and 15 at the airport. Most freezing temperatures last only a few hours because they are usually accompanied by clear skies.

Monthly rainfall is evenly distributed throughout the year. Annual rainfall has varied from 72.86 inches in 1900 to 17.66 inches in 1917. About 75 percent of the years have total precipitation between 30 and 60 inches. Monthly precipitation has ranged from 17.64 inches to only a trace. Because thundershowers are the main source of rainfall, precipitation may vary substantially in different sections of Houston on a day-to-day basis.

About one-fourth of the days each year are clear. October has the most clear days. Cloudy days are relatively frequent from November to May and partly cloudy days are more frequent from June through September. Sunshine averages near 60 percent of the possible amount for the year ranging from 46 percent in winter to 69 percent in summer. Snow is rare. However, in an occasional year several inches will fall in January or February.

Heavy fog occurs on an average of 16 days a year, and light fog occurs about 62 days a year.

Destructive windstorms are fairly infrequent, but both thundersqualls and tropical storms occasionally pass through the area.

The average date of the last temperature of 32 degrees F. or lower in spring is March 2. The average date of the first 32 degrees F. temperature in fall is November 28. The average period from the last 32 degrees F. temperature in spring to the first in fall is 271 days.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are located, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes, the size of streams and the general pattern of drainage, the kinds of native plants or crops, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has been changed very little by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are range site, Edna soil; woodland suitability group 2w9; Blackland woodland grazing group.

Bg—Bernard-Urban land complex. This is a nearly level complex in broad metropolitan areas and rural areas where the population is increasing. The areas are 40 to several hundred acres in size. The slope is 0 to 1 percent but averages 0.5 percent.

The Bernard soil makes up 30 to 80 percent of this complex, and Urban land 10 to 70 percent. Other soils, mainly Lake Charles, Addicks, Edna, and Clodine soils, make up 10 to 20 percent. The areas are so intricately mixed that it was not practical to separate them at the mapping scale for this survey. Pimple mounds are common in a few undisturbed areas of Edna and Clodine soils.

The surface layer of the Bernard soil is friable, neutral, very dark gray clay loam about 6 inches thick. The layer below that is about 48 inches thick and consists of firm, neutral, very dark gray clay in the upper part and very firm, moderately alkaline, dark gray clay in the lower part. The next layer is firm, moderately alkaline, gray clay that has distinct yellowish brown mottles and a few calcium carbonate concretions.

Urban land consists of soils that have been altered or covered by buildings and other urban structures, making classification impractical. Typical structures are single- and multiple-unit dwellings, garages, sidewalks, driveways, streets, schools, and churches. Also there are shopping centers that are less than 40 acres in size, a few single- and multiple-story office buildings, paved parking lots, and industrial sites. Open spaces within developed areas are commonly covered by 4 to 18 inches of clayey fill material. Such areas generally are adjacent to major thoroughfares, recessed streets, and larger commercial buildings. There are some areas that are less than 10 percent covered by buildings and other structures.

In general, this mapping unit has severe limitations for urban development. The major limitation is the high shrink-swell potential. Shrinking and swelling have caused driveways, patios, brick walls and ceilings to crack, sidewalks and streets to buckle, and fences to shift. Corrosivity to uncoated steel pipes is high. Landscaping is difficult, particularly in areas that have been compacted by machinery. Where exposed, the soils are sticky when wet. The soils are not suitable for use as septic tank filter fields.

Bn—Bissonnet very fine sandy loam. This is a nearly level soil in irregularly shaped, timbered areas that have smooth boundaries. The areas average 100 acres in size but some are as large as 500 acres. The surface is plane to slightly convex. The slope is 0 to 1 percent but averages 0.5 percent.

The surface layer is friable, very strongly acid, dark grayish brown very fine sandy loam about 6 inches thick. In a few places, where there are low circular pimple mounds on the surface, the surface layer is slightly thicker. The next layer is friable, very strongly acid, brown and pale brown very fine sandy loam about 22 inches thick. It tongues into the upper part of a layer that is friable, very strongly acid, light brownish gray sandy clay loam. The layer below that, extending to a depth of 70 inches, is firm, very strongly acid, gray clay loam in the upper 10 inches and firm, mildly alkaline, light gray clay loam in the lower 28 inches.

Included with this soil in mapping are small areas of Aldine, Atasco, Hockley, Segno, Wockley, and Ozan soils. These soils make up less than 15 percent of any mapped area.

This soil is used mainly for timber production and woodland grazing. Native vegetation is chiefly pine, hardwoods, sedge, beaked panicum, and little bluestem. A few small open areas are used for pasture and cultivated crops.

This soil is somewhat poorly drained. Surface runoff is slow, and the erosion hazard is slight. The available water capacity is high, and permeability is slow. During some wet seasons this soil has a perched water table, and the lower layers are saturated for 1 to 4 months.

Fertilization, liming, and careful management are needed for crops and pasture. Capability unit IIIw-1; rice group 2; pastureland and hayland group 8A; woodland suitability group 2w8; Flatwoods woodland grazing group.

Bo—Boy loamy fine sand. This soil is nearly level to gently sloping in areas along low terraces of natural drainageways. The areas are oblong and irregular and average 150 acres, but some are 700 acres in size. The surface is plane to slightly depressed or concave. The slope ranges from 0 to 2 percent but averages about 1 percent.

The surface layer is very friable, slightly acid, dark gray loamy fine sand in the upper 5 inches and very friable, strongly acid, grayish brown fine sand in the lower 4 inches. The layer below that is loose, medium acid, fine sand and extends to a depth of 56 inches. It is light yellowish brown in the upper part and very pale brown in the lower part. The next layer, extending to a depth of 75 inches, is friable, very strongly acid, light brownish gray sandy clay loam that has mottles of strong brown and red and is about 10 percent plinthite.

Included with this soil in mapping are areas of other soils that make up less than 15 percent of any mapped area. These include small areas of Kenney soils, small areas of Ozan soils in slight depressions, Hockley or Segno soils that are slightly higher on the landscape, and Voss soils that are slightly lower on the landscape.

This soil is used mainly for timber and woodland grazing. Native vegetation is loblolly pine, shortleaf pine, sweetgum, and southern red oak and an understory of sweetbay, American beautyberry, greenbriar, longleaf uniola, bull nettle, little bluestem, and blackberry vine. A few cleared areas are planted to Coastal bermudagrass, Pensacola bahiagrass, and weeping lovegrass.

This soil is somewhat poorly drained. In wet seasons, the layer that has plinthite and the material just above it are saturated for 2 to 4 months. There is no runoff in some places, and it is very slow in others. Internal films; vertical streaks of uncoated fine sand and silt 2 millimeters thick between prism faces; very strongly acid; gradual wavy boundary.

B22tg—33 to 43 inches; gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common fine and medium distinct yellowish brown (10YR 5/8) mottles and common fine prominent red mottles; weak coarse prismatic structure parting to moderate fine angular blocky; extremely hard, firm, sticky and plastic; patchy clay films; uncoated fine sand and silt coatings on faces of prisms; strongly acid; diffuse wavy boundary.

B23tg—43 to 60 inches; gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common fine prominent red mottles and few fine distinct yellowish brown mottles; weak fine angular blocky structure; extremely hard, firm, sticky and plastic; patchy clay films; medium acid.

The Ap horizon is 3 to 8 inches thick. It is very dark grayish brown, dark grayish brown, grayish brown, dark brown, or brown. It is strongly acid through slightly acid. The A&B horizon is brown, pale brown, very pale brown, yellowish brown, or light yellowish brown. Mottles are strong brown or yellowish brown. The A&B horizon is sandy loam, fine sandy loam, or very fine sandy loam. It is strongly acid through slightly acid. The B&A horizon is yellowish brown, light yellowish brown, or brownish yellow. Mottles are red, yellowish red, strong brown, light brownish gray, or light gray. The B&A horizon is clay loam, silty clay loam, or sandy clay loam. It is very strongly acid through medium acid. The B2t horizon is clay loam, silty clay loam, sandy clay, or clay. It is very strongly acid through medium acid. The matrix in the upper part of the B2t horizon is strong brown, yellowish brown, or brownish yellow. It contains mottles of red, gray, light brownish gray, or light gray. The matrix in the lower part of the B2t horizon is gray, light brownish gray, or light gray. Mottles are red, strong brown, yellowish brown, or brownish yellow. In a few places horizons below a depth of 50 inches contain a few pitted calcium carbonate concretions.

Beaumont Series

The Beaumont series consists of deep, acid, nearly level, clayey soils on upland prairies. These soils formed in thick beds of alkaline marine clay.

Undisturbed areas of these soils have gilgai microrelief, in which the microknolls are 6 to 12 inches higher than the microdepressions. When these soils are dry they have deep, wide cracks that extend to the surface. During rainstorms, water enters the cracks rapidly. When the soils are wet and the cracks are closed, water moves very slowly into the soil. Beaumont soils are poorly drained. Surface runoff and internal drainage are very slow. Permeability is very slow, and the available water capacity is high.

Some of these soils are used for rice and pasture plants. Pine and hardwood trees have encroached in a few areas. Some areas are covered by buildings and other urban structures.

Representative profile of Beaumont clay, in pasture, in the center of a microdepression, from the intersection of Red Bluff Road and Bay Area Boulevard (about 4 miles northeast of Clear Lake City), 1.0 mile northwest along Red Bluff Road, 1.35 miles north on the service road along the east side of Big Island Slough to the intersection with a pipeline, 0.3 mile east along the pipeline, and 100 feet south:

A11—0 to 9 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; common fine and medium distinct mottles of dark reddish brown (5YR 3/3); reddish brown (5YR 4/4) stains along root channels and on ped faces; moderate medium angular blocky structure; very hard, very firm, very sticky and plastic; many fine roots; common pressure faces; common black masses of partly decomposed organic matter; few shotlike iron-manganese concretions; very strongly acid; clear smooth boundary.

A12—9 to 21 inches; gray (10YR 5/1) clay, gray (10YR 6/1) dry; common fine and medium distinct dark brown (7.5YR 4/4) stains along root channels and on ped faces; moderate medium angular blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots; many shiny pressure faces; few worm casts; few black organic stains; few fine iron-mangenese concretions; very strongly acid; gradual wavy boundary.

AC1g—21 to 43 inches; gray (10YR 6/1) clay, light gray (10YR 7/1) dry; many fine and medium distinct mottles of dark brown (7.5YR 4/4); many ped faces coated with gray (10YR 5/1) clay; distinct parallelepipeds parting to moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; common coarse intersecting slickensides; many shiny pressure faces; dark brown stains along root channels; few fine iron-manganese concretions; common cracks 3 to 4 centimeters wide filled with gray (10YR 5/1) clayey material; very strongly acid; diffuse wavy boundary.

AC2g—43 to 59 inches; gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common fine distinct mottles of dark yellowish brown; distinct parallelepipeds parting to moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky and plastic; common coarse intersecting slickensides; common shiny pressure faces; few fine iron-manganese concretions; strongly acid; gradual wavy boundary.

Cg—59 to 73 inches; grayish brown (2.5Y 5/2) clay, light brownish gray (2.5Y 6/2) dry; common fine faint mottles of light olive brown and few fine distinct mottles of strong brown; weak coarse angular blocky structure; extremely hard, very firm, very sticky and plastic; few slickensides; neutral.

The A horizon is 10 to 25 inches thick. It is very dark gray, dark gray, or gray. Mottles are dark reddish brown, reddish brown, dark brown, yellowish brown, or light olive brown. The A horizon is very strongly acid through slightly acid. The ACg horizon is dark gray, gray, or light gray. Mottles are reddish brown, dark brown, dark yellowish brown, strong brown, yellowish brown, or brownish yellow. The ACg horizon is clay or silty clay. It is very strongly acid through medium acid. The Cg horizon is gray, light gray, grayish brown, or light brownish gray. Mottles are yellow or brown. The Cg horizon is clay or silty clay. It is strongly acid through mildly alkaline. In a few places calcium carbonate concretions are below a depth of 65 inches.

Bernard Series

The Bernard series consists of deep, neutral, nearly level to gently sloping, loamy soils on upland prairies. These soils have a loamy surface layer about 6 inches thick underlain by clayey lower layers (fig. 7). They formed in clayey unconsolidated sediments.

These soils are somewhat poorly drained. Surface runoff is very slow. Internal drainage is slow to very slow. Permeability is very slow, and the available water capacity is high.

These soils are used mainly for row crops, improved pasture, and native pasture. A large area is covered by buildings and other urban structures.

Representative profile of Bernard clay loam, in a field, from intersection of Cook Road and Alief Road in Alief, 1.11 miles west along Alief Road, 0.96 mile south on Synott Road, and 80 feet west:

Ap—0 to 6 inches; very dark gray (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; moderate medium granular structure; very hard, friable; many fine roots; common fine pores; common worm casts; few shotlike iron-manganese concretions; neutral; clear smooth boundary.

B1g—6 to 18 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; very hard, firm; common fine roots; common fine pores; patchy clay films; few shotlike iron-manganese concretions; neutral; gradual wavy boundary.

B21tg—18 to 34 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium and coarse blocky structure; few slickensides that do not intersect; extremely hard, very firm, sticky and plastic; few very fine pores; clay films on ped surfaces; few shotlike iron-manganese concretions; mildly alkaline; noncalcareous in matrix; diffuse wavy boundary.

B22tg—34 to 54 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; few fine distinct yellowish brown mottles mainly surrounding iron-manganese and calcium carbonate concretions; weak coarse blocky structure; a few slickensides that do not intersect; extremely hard, very firm, sticky and plastic; few patchy clay films; few shotlike iron-manganese concretions; few irregularly shaped calcium carbonate concretions that have pitted surfaces and that are mainly less than 1 centimeter in size; moderately alkaline; noncalcareous in matrix; gradual wavy boundary.

B3g—54 to 65 inches; gray (5Y 5/1) clay, light gray (5Y 6/1) dry; common vertical streaks of dark gray (10YR 4/1) and few fine distinct yellowish brown and strong brown mottles; massive; very hard, firm, sticky and plastic; few shotlike iron-manganese concretions; about 5 to 7 percent calcium carbonate concretions less than 3 centimeters in size that are irregularly shaped and have pitted surfaces; moderately alkaline, noncalcareous in matrix.

The Ap horizon is 3 to 8 inches thick. It is black, very dark gray or very dark grayish brown and is slightly acid through moderately alkaline. The B1g horizon is the same color as the A horizon. It is clay, clay loam, or silty clay loam that is more than 35 percent clay. It is neutral through moderately alkaline. The B2tg horizon is black, very dark gray, dark gray, gray, very dark grayish brown, dark olive gray, dark grayish brown, olive gray, or grayish brown. It has mottles of yellow or brown. It is clay or silty clay, and is mildly alkaline through moderately alkaline. The B3g horizon is gray, light gray, grayish brown, light brownish gray, olive gray, or light olive gray. It is mottled with yellow, brown, or olive in most places. It is clay, clay loam, or silty clay loam.

Bissonnet Series

The Bissonnet series consists of deep, nearly level, loamy soils on forested uplands. The loamy upper layers of these soils tongue into the more clayey lower layers (fig. 8). These soils formed in thick beds of unconsolidated clay and clay loam sediments.

These soils are somewhat poorly drained. During some wet seasons, they have a perched water table and the lower layers are saturated for 1 to 4 months. Surface runoff and permeability are slow and the available water capacity is high.

Most of these soils are in pine and hardwood trees. Woodland grazing is the main use. A few areas have been cleared and are used for improved pasture and cultivated crops.

Representative profile of Bissonnet very fine sandy loam, in timber, from the intersection of Farm Roads 1960 and 2100 in Huffman, 3.4 miles south along Farm Road 2100, 1.72 miles west on Indian Shores Road, and 400 feet south:

A1—0 to 6 inches; dark grayish brown (10YR 4/2) very fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable; few fine roots; common fine pores; common worm casts; very strongly acid; clear wavy boundary.

A21—6 to 24 inches; brown (10YR 5/3) very fine sandy loam, very pale brown (10YR 7/3) dry; few fine faint yellowish brown mottles and strong brown stains; many sand and silt grains are uncoated; weak fine granular structure; slightly hard, friable; few fine roots; few fine pores; few worm casts; very strongly acid; clear wavy boundary.

A22—24 to 28 inches; pale brown (10YR 6/3) very fine sandy loam, very pale brown (10YR 7/3) dry; few fine faint yellowish brown mottles; many sand and silt grains are uncoated; weak fine granular structure; slightly hard, friable; few fine roots; few fine pores; few worm casts; very strongly acid; clear smooth boundary.

B&A—28 to 32 inches; light brownish gray (10YR 6/2) sandy clay loam, light gray (10YR 7/2) dry; common fine distinct mottles of yellowish brown, strong brown, and red; 15 to 30 percent light gray (10YR 7/2) very fine sandy loam surrounding isolated bodies of more clayey Bt material; weak medium subangular blocky structure; hard, friable; few fine roots; few fine pores, some lined with clay; reddish stains in old root channels; few clay films on surfaces of some peds; few black concretions; many uncoated sand grains; very strongly acid; clear irregular boundary.

B21tg—32 to 42 inches; gray (10YR 6/1) clay loam, light gray (10YR 7/1) dry; common medium prominent red (2.5YR 4/6) mottles and common fine distinct yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; few fine roots; few fine pores; discontinuous clay films on faces of peds; some ped surfaces covered with uncoated fine sand and silt grains; very strongly acid; gradual boundary.

B22tg—42 to 70 inches; gray (10YR 6/1) clay loam, light gray (10YR 7/1) dry; common medium distinct yellowish brown (10YR 5/6) mottles and few fine prominent red mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; discontinuous clay films on faces of peds; some surfaces of peds covered with uncoated fine sand and silt grains; some organic staining on faces of prisms; mildly alkaline in lower part of horizon; noncalcareous.

The A horizon is 20 to 40 inches thick. It is very strongly acid through medium acid. The A1 horizon is dark gray, dark grayish brown, gray, grayish brown, or brown. The A2 horizon is grayish brown, brown, light brownish gray, pale brown, or light yellowish brown. Some profiles have mottles of strong brown, brownish yellow, or yellowish brown in the A2 horizon. The B&A horizon is light brownish gray, pale brown, brown, yellowish brown, or light yellowish brown. It is sandy clay loam, loam, or silty loam. The B&A horizon has mottles of strong brown, yellowish brown, or red. It is very strongly acid through medium acid. The B2t horizon is gray, light brownish gray, or light gray. Mottles are brownish yellow, yellowish brown, strong brown, or red. The B2t horizon is clay loam, sandy clay loam, or silty clay loam. It is very strongly acid through slightly acid in the upper part. It ranges to mildly alkaline in the lower part in some places.

Boy series

The Boy series consists of deep, acid, nearly level to gently sloping, sandy soils in forest. These soils formed in unconsolidated beds of sand, loamy sand, and loam.

These soils are somewhat poorly drained. During wet periods they are saturated for 2 to 4 months in the layer containing plinthite and the soil just above it. Surface runoff is very slow, and in places it is not a hazard at all. Internal drainage and permeability are rapid above the layer containing plinthite, and permeability is moderately slow in the layer containing plinthite. The available water capacity is low.

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

[Data from Houston, elevation 96 feet. Period of record 1931-70]

Month	Temperature				Precipitation											
						Probability of receiving--								Mean number of days with--		
	Mean daily maximum	Mean monthly maximum	Mean daily minimum	Mean monthly minimum	Mean total	0 or trace	.5 inch or more	1 inch or more	2 inches or more	3 inches or more	4 inches or more	5 inches or more	6 inches or more	.1 inch or more	.5 inch or more	1 inch or more
	F	F	F	F	In	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct			
January---	63.6	78.6	43.6	25.0	3.78	<1	97	92	74	54	35	24	14	5	2	1
February--	65.5	79.8	46.0	30.1	3.44	<1	96	90	70	49	30	19	14	5	2	1
March-----	71.7	84.4	50.8	34.1	2.67	<1	93	80	58	38	25	18	10	4	1	1
April-----	78.0	88.0	59.0	45.5	3.24	<1	96	90	70	50	35	20	14	4	2	1
May-------	85.7	91.9	66.2	55.6	4.32	<1	93	85	73	55	43	33	22	5	3	2
June------	91.1	96.2	72.0	65.0	3.69	<1	93	82	63	45	34	25	16	5	3	2
July------	92.1	98.0	73.8	70.2	4.29	<1	96	90	75	55	40	30	25	5	2	1
August----	92.8	98.7	73.6	68.7	4.27	<1	95	85	70	50	40	30	20	6	3	2
September-	89.1	95.7	69.3	59.2	4.26	<1	95	86	70	55	40	30	25	6	3	1
October---	82.3	91.3	60.4	46.1	3.77	3	85	85	55	40	30	20	11	5	2	1
November--	71.1	84.9	50.5	34.1	3.86	<1	94	83	65	50	33	23	20	5	2	1
December--	64.5	79.8	45.9	28.7	4.36	<1	99	95	80	60	50	33	24	6	3	1
Year----	79.0	88.9	59.3	46.9	45.95	--	--	--	--	--	--	--	--	61	28	15

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea-bility	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
Bernard:									
Bd	0-6	0.06-0.2	0.15-0.20	6.1-7.3	Moderate	High	Low	0.32	5
	6-34	<0.06	0.12-0.18	6.1-7.8	High	High	Low	0.32	
	34-65	<0.06	0.15-0.20	6.6-8.4	High	High	Low	0.32	
[1]Be:									
Bernard part	0-6	0.06-0.2	0.15-0.20	6.1-7.3	Moderate	High	Low	0.32	5
	6-34	<0.06	0.12-0.18	6.1-7.8	High	High	Low	0.32	
	34-65	<0.06	0.15-0.20	6.6-8.4	High	High	Low	0.32	
Edna part	0-10	0.6-2.0	0.10-0.15	5.6-7.3	Low	High	Low	0.43	5
	10-41	<0.06	0.15-0.20	5.6-7.3	High	High	Low	0.37	
	41-72	<0.06	0.15-0.20	6.6-8.4	High	High	Low	0.37	
[1]Bg:									
Bernard part	0-6	0.06-0.2	0.15-0.20	6.1-7.3	Moderate	High	Low	0.32	5
	6-34	<0.06	0.12-0.18	6.1-7.8	High	High	Low	0.32	
	34-65	<0.06	0.15-0.20	6.6-8.4	High	High	Low	0.32	5
Urban land part.									
Bissonnet:									
Bn	0-28	0.6-2.0	0.14-0.18	4.5-6.0	Low	Low	Moderate	0.43	5
	28-32	0.2-0.6	0.15-0.19	4.5-6.0	Low	Moderate	Moderate	0.43	
	32-70	0.06-0.2	0.16-0.22	4.5-7.8	Moderate	Moderate	Moderate	0.43	
Boy:									
Bo	0-56	6.0-20	0.05-0.10	4.5-6.5	Low	Low	High	0.17	5
	56-75	0.2-0.6	0.10-0.15	4.5-6.0	Low	Low	High	0.24	
Clodine:									
Cd	0-12	0.6-2.0	0.15-0.20	6.1-7.8	Low	High	Low	0.32	5
	12-29	0.6-2.0	0.15-0.20	6.1-8.4	Moderate	High	Low	0.32	
	29-72	0.6-2.0	0.12-0.20	6.6-8.4	Moderate	High	Low	0.32	
[1]Ce:									
Clodine part	0-12	0.6-2.0	0.15-0.20	6.1-7.8	Low	High	Low	0.32	5
	12-29	0.6-2.0	0.15-0.20	6.1-8.4	Moderate	High	Low	0.32	
	29-72	0.6-2.0	0.12-0.20	6.6-8.4	Moderate	High	Low	0.32	
Urban land part.									
Edna:									
Ed	0-5	0.6-2.0	0.10-0.15	5.6-7.3	Low	High	Low	0.43	5
	5-41	<0.06	0.15-0.20	5.6-7.3	High	High	Low	0.37	
	41-72	<0.06	0.15-0.20	6.6-8.4	High	High	Low	0.37	
Gessner:									
Ge, [1]Gs	0-16	0.6-2.0	0.10-0.15	6.1-7.8	Low	High	Low	0.43	5
	16-80	0.6-2.0	0.15-0.20	6.6-8.4	Low	High	Low	0.43	
[1]Gu:									
Gessner part	0-16	0.6-2.0	0.10-0.15	6.1-7.8	Low	High	Low	0.43	5
	16-80	0.6-2.0	0.15-0.20	6.6-8.4	Low	High	Low	0.43	
Urban land part.									
Harris:									
Ha	0-20	0.06-0.2	0.02-0.20	6.6-9.0	High	High	High	0.20	5
	20-45	<0.06	0.01-0.10	6.6-9.0	High	High	High	0.32	
	45-64	<0.06	0.01-0.10	6.6-9.0	High	High	High	0.32	
Hatliff:									
Hf	0-10	2.0-6.0	0.11-0.15	5.1-7.3	Low	Low	Moderate	0.24	5
	10-80	2.0-6.0	0.05-0.11	5.1-7.3	Low	Low	Moderate	0.24	
Hockley:									
HoA, HoB	0-23	2.0-6.0	0.10-0.15	5.1-6.5	Low	Low	Low	0.24	5
	23-50	0.6-2.0	0.12-0.17	5.1-6.5	Moderate	Moderate	Low	0.32	
	50-80	0.2-0.6	0.10-0.15	5.1-6.5	Moderate	Moderate	Low	0.28	

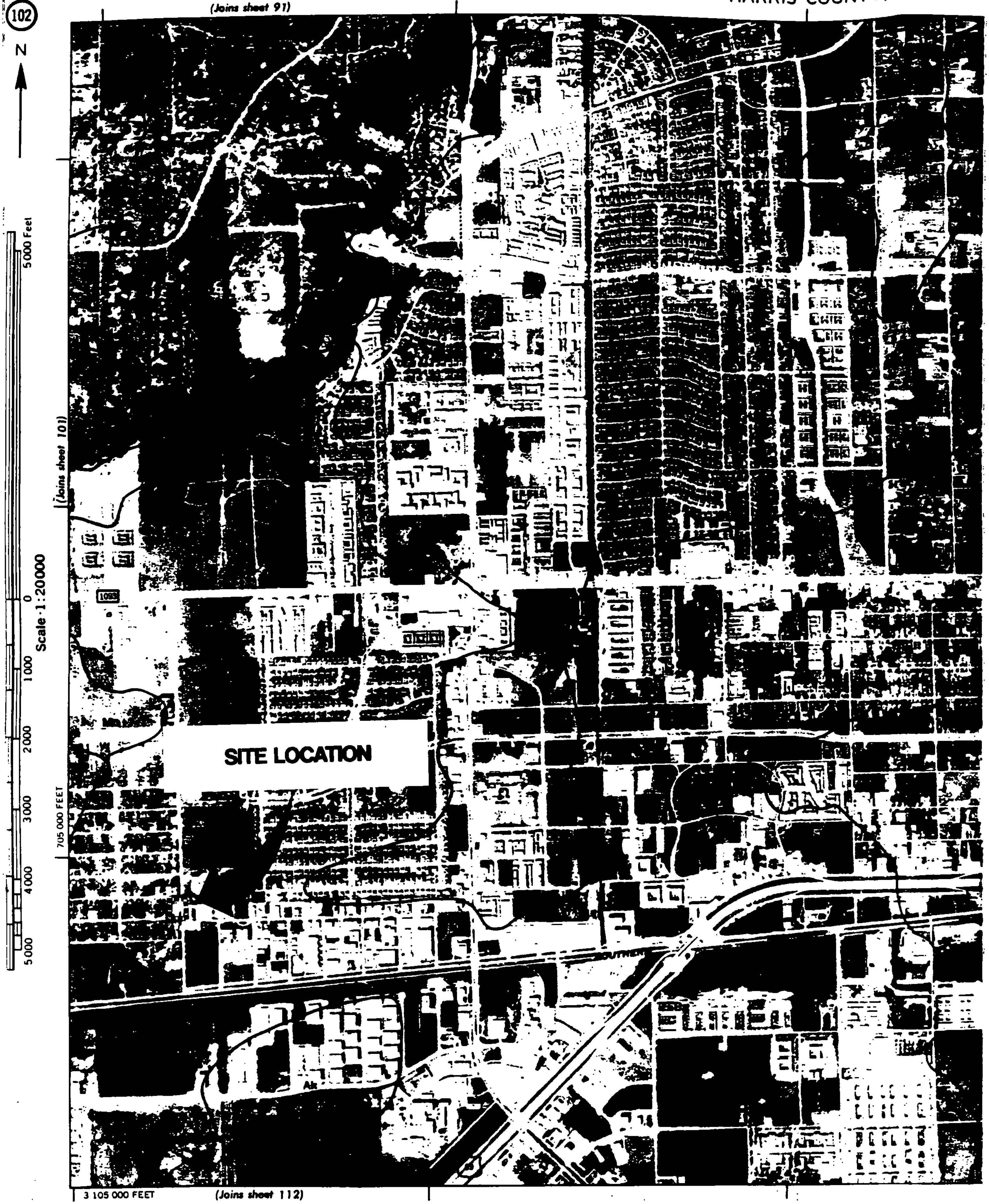
See footnotes at end of table.

TABLE 18.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. The symbol < means less than; > means greater than]

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months
					Ft		
Addicks:							
Ad	D	None	---	---	1.0-2.5	Apparent	Jan-Feb
[1]Ak:							
Addicks part	D	None	---	---	1.0-2.5	Apparent	Jan-Feb
Urban land part.							
Aldine:							
Am	D	None	---	---	1.5-2.5	Perched	Nov-May
[1]An:							
Aldine part	D	None	---	---	1.5-2.5	Perched	Nov-May
Urban land part.							
Aris:							
Ap	D	None	---	---	0-2.0	Perched	Nov-Mar
[1]Ar:							
Aris part	D	None	---	---	0-2.0	Perched	Nov-Mar
Gessner part	B/D	None	---	---	0-2.0	Apparent	Nov-May
[1]As:							
Aris part	D	None	---	---	0-2.0	Perched	Nov-Mar
Urban land part.							
Atasco:							
AtB	C	None	---	---	1.5-2.5	Perched	Nov-Feb
Beaumont:							
Ba	D	Rare	---	---	0-2.0	Apparent	Nov-Mar
[1]Bc:							
Beaumont part	D	Rare	---	---	0-2.0	Apparent	Nov-Mar
Urban land part.							
Bernard:							
Bd	D	None	---	---	0-3.0	Apparent	Dec-Feb
[1]Be:							
Bernard part	D	None	---	---	0-3.0	Apparent	Dec-Feb
Edna part	D	None	---	---	0-1.5	Perched	Dec-Mar
[1]Bg:							
Bernard part	D	None	---	---	0-3.0	Apparent	Dec-Feb
Urban land part.							
Bissonnet:							
Bn	D	None	---	---	2.0-3.5	Perched	Nov-Feb
Boy:							
Bo	B	None	---	---	3.5-5.5	Perched	Nov-Feb
Clodine:							
Cd	D	None	---	---	0-2.5	Apparent	Dec-Mar
[1]Ce:							
Clodine part	D	None	---	---	0-2.5	Apparent	Dec-Mar
Urban land part.							

See footnotes at end of table.


102
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N
(Joins sheet 101)
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Scale 1:20000
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1093
SITE LOCATION
3 105 000 FEET
(Joins sheet 112)

REFERENCE 22

U.S. DEPARTMENT OF COMMERCE
LUTHER H. HODGES, Secretary

WEATHER BUREAU
F. W. REICHELDERFER, Chief

TECHNICAL PAPER NO. 40

RAINFALL FREQUENCY ATLAS OF THE UNITED STATES

for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years

Prepared by
DAVID M. HERSHFIELD
Cooperative Studies Section, Hydrologic Services Division
for
Engineering Division, Soil Conservation Service
U.S. Department of Agriculture

THIS ATLAS IS OBSOLETE FOR THE FOLLOWING 11 WESTERN STATES: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

NOAA ATLAS 2: PRECIPITATION-FREQUENCY ATLAS OF THE WESTERN UNITED STATES (GPO: 11 Vols., 1973) supersedes the Technical Paper 40 data for these states.

All but 3 of the 11 state volumes are out of print, and no reprint is presently planned.

Institutions in the eleven western states likely to have copies of these volumes for their state for public inspection are:

- US Department of Agriculture Soil Conservation Service Offices
- US Army Corps of Engineers Offices
- Selected University Libraries
- National Weather Service Offices (may also have volumes for adjacent states).
- National Weather Service Forecast Offices (may have all eleven volumes)

Elsewhere, libraries of universities where hydrology and meteorology degree programs are offered may shelve some of the eleven volumes.

The three volumes in print as of 1 Jan 1983 at the GPO are:

Vol	State	GPO Stock Number	Price
IV	New Mexico	003-017-00158-0	$10.00
VI	Utah	003-017-00160-1	12.00
VII	Nevada	003-017-00161-0	9.50

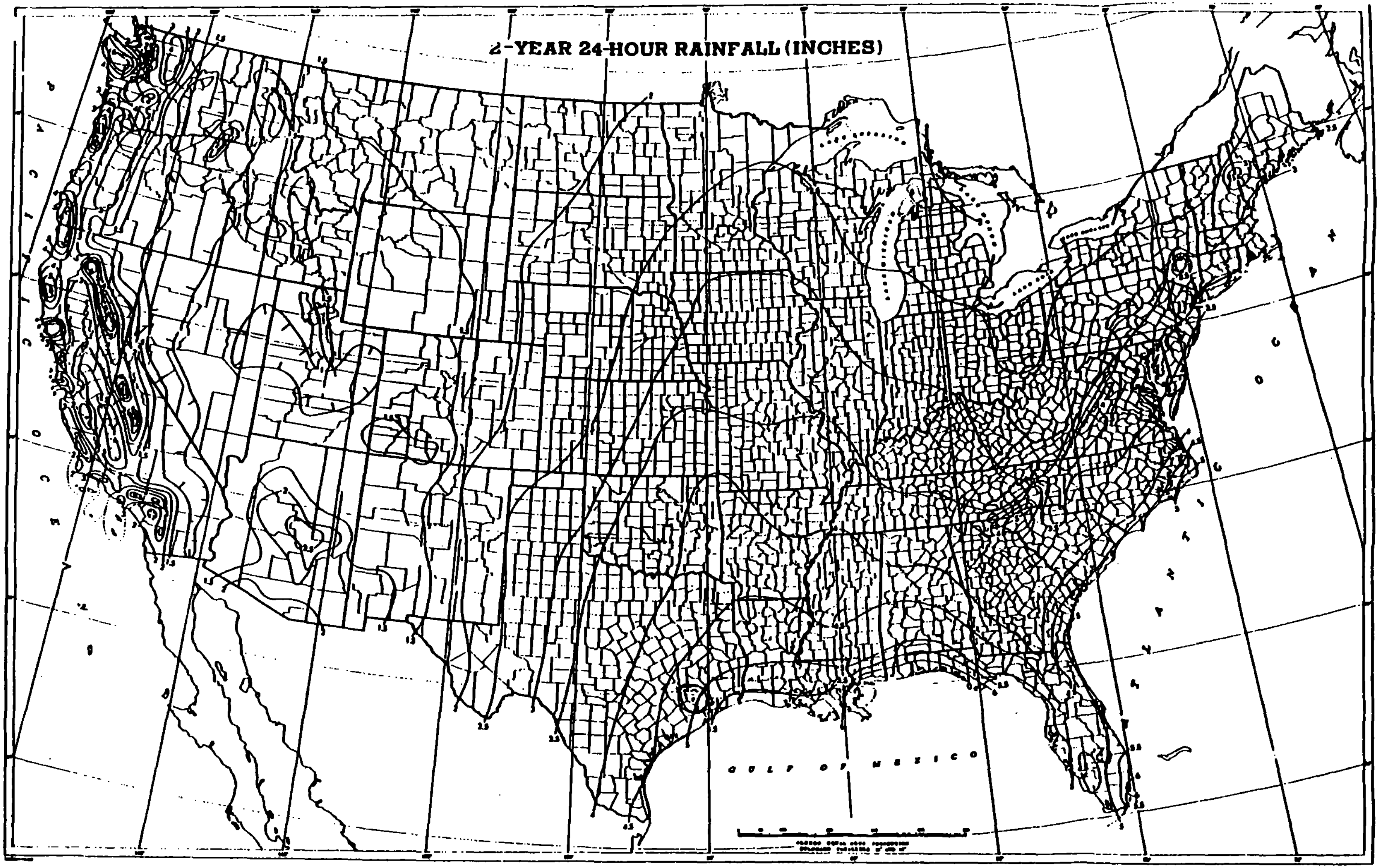
The GPO order number is 202-783-3238 for VISA and MASTERCARD orders which

NOTICE

Rainfall-frequency information for durations of 1 hour and less for the Central and Eastern States has been superseded by NOAA Technical Memorandum NWS HYDRO-35 Five to Sixty-Minute Precipitation Frequency for the Eastern and Central United States. This publication (Accession No. PB 272-112/AS) is obtainable from:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

WASHINGTON, D.C.
May 1961



2-YEAR 24-HOUR RAINFALL (INCHES)
GULF OF MEXICO

REFERENCE 23

TEXAS
PARKS AND WILDLIFE DEPARTMENT
4200 Smith School Road • Austin, Texas 78744 • 512-389-4800

July 9, 1991

Kim Birdsall
1509 Main Street
Dallas, TX 75201
(214) 744-1641

Mark A. Webb
Inland Fisheries District Office
1004 East 26th Street
Bryan, TX 77803
(409) 822-5067

Dear Kim,

In answer to your inquiry about the fishery of Buffalo Bayou the enclosed draft of a report is all I have in my files. I'll keep looking for a completed report or additional information. If you have questions please call.

Sincerely,

Mark A. Webb

Mark A. Webb
District Management Supervisor

Report of Fish Sampling, Buffalo Bayou

To gather some information on the fish community in the western end of Buffalo Bayou, Harris County, Texas, fish collections were made with an electrofishing unit and a 20-ft. common sense minnow seine on August 3, 1978.

Description of Bayou

Buffalo Bayou, approximately one mile upstream from Wilcrest Drive bridge, ranges from 20 to 80 feet wide. The depth of the water varies from 6 inches to 3½ feet. The bayou has two riffle areas, about 50 feet in length; the substrate is primarily rock and gravel in the middle and silt deposits along the shoreline.

At the Wilcrest Drive bridge the bayou narrows to approximately 15 feet; the water was approximately 2 feet deep. Below the bridge, downstream, the bayou ranges from 30 to 90 feet in width. The water depth ranges from 1½ to approximately 6 feet.

At the time of the sampling, the water level was normal and the turbidity was an estimated 2 inches. In general the banks are gently sloping; in some places they are sharply cut. Along most of the bayou the banks are heavily covered with Chinaberry, willow and cottonwood trees. Debris of all kinds is common along the bayou.

Aquatic vegetation consists of alligator weed, water pennywort, duck potato and spikerush.

Fish Collections

One 5-minute and two 20-minute electrofishing collections were made. In addition, one seining collection was made.

Collection 1. Results of electrofishing, 20-minute sample, Buffalo Bayou, 1 mile upstream from Wilcrest Drive bridge, August 3, 1978.

Species	Number	Estimated Weight (lbs.)
Spotted gar	1	1
Longnose gar	1	1

Gizzard shad	2	¼
Smallmouth buffalo	6	2-5
Channel catfish	2	¼
Flathead catfish	4	¼-20

Collection 2. Results of electrofishing, 20-minute sample, Buffalo Bayou, 1 mile downstream from Wilcrest Drive bridge, August 3, 1978.

Species	Number	Estimated Weight (lbs.)
Spotte gar	16	½-3
Smallmouth buffalo	4	5-12
Flathead catfish	1	10

Collection 3. Results of electrofishing, 5-minute sample, Buffalo Bayou, 300 ft. downstream from Collection 2, August 3, 1978.

Species	Number	Estimated Weight (lbs.)
Alligator gar	1	50
Spotted gar	2	1
Smallmouth buffalo	2	3-5

Collection 4. Results of seining, 2 40-foot drags, Buffalo Bayou, near Wilcrest Drive bridge, August 3, 1978.

Species	Number	Total Length (inches)
Mosquitofish	274	1
Mosquitofish	3	2

Several large, in excess of 50 pounds each, alligator gar were observed; however, they were too large to pick up with our dip nets. In addition, two redear turtles were observed.

All fish were returned to the bayou. Most of them were alive except the shad and some of the gar.

Discussion

The western end of Buffalo Bayou is an interesting stream. The first impression a person ~~one~~ is likely to get is that this is just a turbid, litter-filled stream with few, if any, desirable fish.

In its riparian state, there is limited access to the bayou due to the luxuriant growth of trees along the banks. Anglers who wish to fish are limited primarily to the road crossings. There was little evidence of any sport fishing activity along the section of the bayou we worked. No anglers were seen. Boat traffic is impeded by fallen trees. The depth of the water ranged from 6 inches to 6 feet; the average depth was less than 3 feet.

However, eight species of fish were collected. Four species could be classified as predators, alligator, spotted and longnose gar, and flathead catfish. The alligator gar and the flathead catfish were the most impressive fish found in Buffalo Bayou. The small channel catfish and flathead catfish indicate successful natural reproduction. Probably the most important forage species found was the gizzard shad.

Conclusions

Additional fish collections should be made below Barker Dam as soon as possible. Messrs. Max Bargsley and Jim Mladenka of the Corps of Engineers office at Barker Dam reported that anglers frequently catch largemouth bass, crappie, bream and blue catfish below the dam.

No photographs were taken; however, photographs should be taken on the next field trip to record the conditions of the bayou and the size of the fish collected.

The field work was done by Johnny Melcer, Ray Vrana and

Charlie Menn of the Texas Parks and Wildlife Department.

Prepared by: ______________________
C. T. Menn

Date: August 9, 1978

REFERENCE 24

TEXAS * WATER * COMMISSION

8900 Shoal Creek Blvd., Bldg. 200 , Austin, Tx. 78758
Telefax #: (512) 371-6202

FAX COVER LETTER

DATE: 7-9-91

TO:

Company: ICS TECHNOLOGY
Name: KIM BIRDSALL
City: DALLAS State: TEXAS
Fax #: 214 747 1826

FROM:

Company: TEXAS WATER COMMISSION
Name: ARLETTE CAPEHART
Phone No.: 512--371-6390

COMMENTS:

Total Number of Pages Being Sent Including This Cover Sheet 5

For Verification of Telecommunications Transmission.
Please Contact the Operator at (512) 371-6201

STATUS
NUMBER
TYPE
BASIN
COUNTY
RIVER ORDER NO.
PERMIT NO.
OWNER(S)
STREAM
TYPE OF USE
AMOUNT OF WATER
NUMBER OF ACRES
PRIORITY DATE
RESERVOIR CAPACITY
DATE ISSUED
TERM STATUS

TYPE OF WATER USES

1. MUNICIPAL/DOMESTIC
2. INDUSTRIAL
3. IRRIGATION
4. MINING
5. HYDROELECTRIC
6. NAVIGATION
7. RECREATION
8. FLOOD CONTROL
9. RECHARGE

TYPE OF WATER RIGHTS

1 - APPLICATION/PERMIT
2 - CLAIM
3 - CERTIFIED FILING
5 - DISMISSED/REJECTED
6 - CERTIFICATION OF ADJUDICATION
9 - CONTRACTUAL PERMIT/AGREEMENT

STATUS OF WATER RIGHTS

A - ADJUDICATED
P - PARTIALLY CANCELLED
R - DISMISSED/REJECTED
T - TOTALLY CANCELLED

TERM STATUS

A - SPECIFIC DATE
B - NO SPECIFIC DATE
C - PERMIT TO BE REDUCED IF AWARDED A RIGHT UNDER CLAIM
D - NOT AUTHORIZED TO USE UNTIL AMENDED

BASIN CODES

1. CANADIAN
2. RED
3. SULPHUR
4. CYPRESS
5. SABINE
6. NECHES
7. NECHES-TRINITY
8. TRINITY
9. TRINITY-SAN JACINTO
10. SAN JACINTO
11. SAN JACINTO-BRAZOS
12. BRAZOS
13. BRAZOS-COLORADO
14. COLORADO
15. COLORADO-LAVACA
16. LAVACA
17. LAVACA-GUADALUPE
18. GUADALUPE
19. SAN ANTONIO
20. SAN ANTONIO-NUECES
21. NUECES
22. NUECES-RIO GRANDE
23. RIO GRANDE

COUNTY CODE LIST

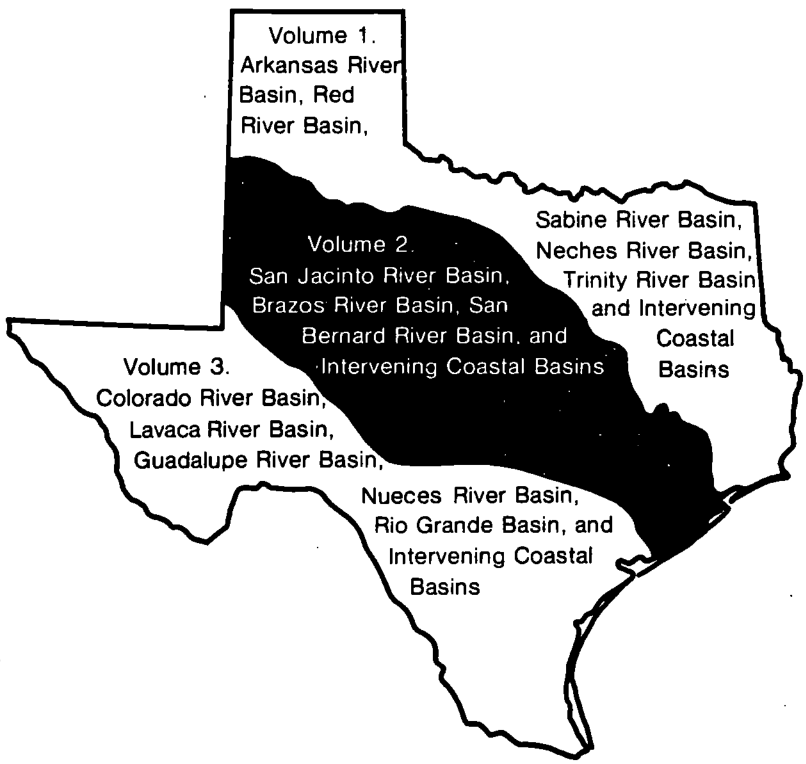
1-Anderson
2-Andrews
3-Angelina
4-Aransas
5-Archer
6-Armstrong
7-Atascosa
8-Austin
9-Bailey
10-Bandera
11-Bastrop
12-Baylor
13-Bee
14-Bell
15-Bexar
16-Blanco
17-Borden
18-Bosque
19-Bowie
20-Brazoria
21-Brazos
22-Brewster
23-Briscoe
24-Brooks
25-Brown
26-Burleson
27-Burnet
28-Caldwell
29-Calhoun
30-Callahan
31-Cameron
32-Camp
33-Carson
34-Cass
35-Castro
36-Chambers
37-Cherokee
38-Childress
39-Clay
40-Cochran
41-Coke
42-Coleman
43-Collin
44-Collingsworth
45-Colorado
46-Comal
47-Comanche
48-Concho
49-Cooke
50-Coryell
51-Cottle
52-Crane
53-Crockett
54-Crosby
55-Culberson
56-Dallam
57-Dallas
58-Dawson
59-Deaf Smith
60-Delta
61-Denton
62-DeWitt
63-Dickens
64-Dimmit
65-Donley
66-Duval
67-Eastland
68-Ector
69-Edwards
70-Ellis
71-El Paso
72-Erath
73-Falls
74-Fannin
75-Fayette
76-Fisher
77-Floyd
78-Foard
79-Fort Bend
80-Franklin
81-Freestone
82-Frio
83-Gaines
84-Galveston
85-Garza
86-Gillespie
87-Glasscock
88-Goliad
89-Gonzales
90-Gray
91-Grayson
92-Gregg
93-Grimes
94-Guadalupe
95-Hale
96-Hall
97-Hamilton
98-Hansford
99-Hardeman
100-Hardin
101-Harris
102-Harrison
103-Hartley
104-Haskell
105-Hays
106-Hemphill
107-Henderson
108-Hidalgo
109-Hill
110-Hockley
111-Hood
112-Hopkins
113-Houston
114-Howard
115-Hudspeth
116-Hunt
117-Hutchinson
118-Irion
119-Jack
120-Jackson
121-Jasper
122-Jeff Davis
123-Jefferson
124-Jim Hogg
125-Jim Wells
126-Johnson
127-Jones
128-Karnes
129-Kaufman
130-Kendall
131-Kenedy
132-Kent
133-Kerr
134-Kimble
135-King
136-Kinney
137-Kleberg
138-Knox
139-Lamar
140-Lamb
141-Lampasas
142-La Salle
143-Lavaca
144-Lee
145-Leon
146-Liberty
147-Limestone
148-Lipscomb
149-Live Oak
150-Llano
151-Loving
152-Lubbock
153-Lynn
154-McCulloch
155-McLennan
156-McMullen
157-Madison
158-Marion
159-Martin
160-Mason
161-Matagorda
162-Maverick
163-Medina
164-Menard
165-Midland
166-Milam
167-Mills
168-Mitchell
169-Montague
170-Montgomery
171-Moore
172-Morris
173-Motley
174-Nacogdoches
175-Navarro
176-Newton
177-Nolan
178-Nueces
179-Ochiltree
180-Oldham
181-Orange
182-Palo Pinto
183-Panola
184-Parker
185-Parmer
186-Pecos
187-Polk
188-Potter
189-Presidio
190-Rains
191-Randall
192-Reagan
193-Real
194-Red River
195-Reeves
196-Refugio
197-Roberts
198-Robertson
199-Rockwall
200-Runnels
201-Rusk
202-Sabine
203-San Augustine
204-San Jacinto
205-San Patricio
206-San Saba
207-Schleicher
208-Scurry
209-Shackelford
210-Shelby
211-Sherman
212-Smith
213-Somervell
214-Starr
215-Stephens
216-Sterling
217-Stonewall
218-Sutton
219-Swisher
220-Tarrant
221-Taylor
222-Terrell
223-Terry
224-Throckmorton
225-Titus
226-Tom Green
227-Travis
228-Trinity
229-Tyler
230-Upshur
231-Upton
232-Uvalde
233-Val Verde
234-Van Zandt
235-Victoria
236-Walker
237-Waller
238-Ward
239-Washington
240-Webb
241-Wharton
242-Wheeler
243-Wichita
244-Wilbarger
245-Willacy
246-Williamson
247-Wilson
248-Winkler
249-Wise
250-Wood
251-Yoakum
252-Young
253-Zapata
254-Zavala

STATUS	EDITPR NO.		TYPE	BASIN	COUNTY	RIVER ORDER NO.	PERMIT NO.	OWNER	STREAM	TYPE OF USE	AMOUNT OF WATER	NO. OF ACRES	PRIORITY DATE	RESERVOIR CAPACITY	DATE ISSUED
A	003000		1	10	101	1200000000	002731	GENERAL PORTLAND INC	BUFFALO BAYOU	2	1615		19720327		19720517
T	002388		1	10	101	1275000000	002162	HOUSTON L&P CO-GABLE	BUFFALO	2	103527	625	19650407		19650615
	005209		1	10	101	1300000000	005209	INWOOD FOREST GOLF CLUB LTD	WHITE OAK BAYO	3	230	98	19881215	16	19890406
T	000390		3	10	101	1400000000		GLENWOOD CEMETARY ASSN	BUFFALO	3	0000000030	0000020	19140623		19140630
A	003072		1	10	101	1400700000	002790	THE MUSEUM OF FINE ARTS	BUFFALO BAYOU	3	19	8	19720911		19721101
	003986		6	10	101	1400700000		MUSEUM OF FINE ARTS	BUFFALO BAYOU	3	19	8	19720911		19860314
A	003850		1	10	101	1400800000	003556	RIVER OAKS COUNTRY CLUB	BUFFALO BAYOU	3	460	129	19780130	75	19780412
	003985		6	10	101	1400800000		RIVER OAKS COUNTRY CLUB	BUFFALO	3	460	129	19780130	75	19860314
	005336		1	10	101	1800000000	005336	HOUSTON COUNTRY CLUB	BUFFALO BAYOU	3	175	118	19901205	20	19910319
A	003275		2	10	101	1980000000		JOSEPH W TAYLOR ET AL	BUFFALO BAYOU	3	6	6	19690829		19700220
T	000923		1	10	101	2000000000	000879	J A RUSH	BUFFALO	3	0000000080	0000040	19250516	0004	19260818
	005257		1	10	101	2500000000	005257	LAKESIDE COUNTRY CLUB	BUFFALO BAYOU	3	175	70	19890913	75	19900529
T	000162		3	10	101	2600000000		A STOCKDICK ESTATE	SO MAYDE	3	0000000000	0000000	19140507		19140613
A	003350		2	10	101	2620000000		LENOIR M JOSEY INC	LANGHAM	3	50	200	19690830		19700227
	003984		6	10	101	2620000000		LENOIR M. JOSEY, INC.	LANGHAM	3	26	56	19630630		19860314
	005332		1	10	101	2623000000	005332	PINE FOREST COUNTRY CLUB	BEAR CRK	3	378	150	19901128	35	19910319
	004066	A	1	10	101	2625000000	003779A	MARIAN W FLEMING	BEAR CR	3	45	25	19800811	9	19801209
A	002031		2	10	101	2630000000		HAROLD FREEMAN	BEAR CR	3	800	0000400	19690826	0150	19691114
	003983		6	10	101	2630000000		HAROLD & JESSE FREEMAN	BEAR	3	800	408	19161231	150	19860314
A	001251		2	10	079	2800000000		JAMIE A ROBINSON ET AL	BUFFALO B	3	0000000200	0000100	19690825		19690930
	003982		6	10	079	2800000000		CINCO RANCH VENTURE	BUFFALO	3	45	29	19520630		19860314
A	001252		2	10	101	2810000000		JAMIE A ROBINSON ET AL	BUFFALO B	3	0000000100	0000100	19690825		19690930
A	001253		2	10	101	2820000000		JAMIE A ROBINSON ET AL	BUFFALO BAYOU	3	0000000100	0000050	19690825		19690930
T	000013		3	10	101	3000000000		SAN JACINTO RICE CO	S JACINTO	3	0000021000	0014000	19131216		19131229
T	001519		1	10	101	3400000000	001414	TEXAS BUTADIENE-CHEM	S JACINTO	3	0000000640	0000320	19470521		19470719
R	000514	R	4	10	101	3600000000	0000000	SIEBER AND FLEMING	S JACINTO	3			19200915		
	005334		1	10	101	3640000000	005334	COOPER'S MARINE SER. INC	OLD RIVER CH	2			19901127		19910319

REFERENCE 25

Water Resources Data Texas Water Year 1987

Volume 2. San Jacinto River Basin, Brazos River Basin, San Bernard River Basin, and Intervening Coastal Basins



U.S. GEOLOGICAL SURVEY WATER-DATA REPORT TX-87-2
Prepared in cooperation with the State of Texas
and with other agencies

CONTENTS

ILLUSTRATION

08074000 BUFFALO BAYOU AT HOUSTON, TX

LOCATION.--Lat 29°45'36", long 95°24'30", Harris County, Hydrologic Unit 12040104, on right bank at downstream side of bridge on Shepherd Drive in Houston and 0.8 mi upstream from Waugh Drive.

DRAINAGE AREA.--358 mi², unadjusted for basin boundary changes.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--May 1936 to September 1957, October 1957 to December 1961 (high-water records and discharge measurements), January 1962 to September 1975, October 1975 to current year (high-water records and discharge measurements).

REVISED RECORDS.--WSP 1732: Drainage area (former site).

GAGE.--Water-stage recorder and crest-stage gages. Datum of gage is 1.36 ft below National Geodetic Vertical Datum of 1929, 1973 adjustment; records unadjusted for land-surface subsidence. Prior to June 19, 1936, nonrecording gage, and June 19, 1936 to Jan. 16, 1962, water-stage recorder at site 0.8 mi downstream at 4.08-foot lower datum. Jan. 17, 1962 to Sept. 30, 1973, auxiliary water-stage recorder 0.8 mi downstream. Water-stage recorder at Main Street (station 08074600) used as auxiliary gage after Sept. 30, 1973.

REMARKS.--No estimated daily discharges. Records fair. Although floodflows are regulated by Barker and Addicks Reservoirs (stations 08072500 and 08073000) located 26.3 and 26.8 mi upstream, respectively, flood peaks from the urbanized areas below these reservoirs are often independent of the regulation. Discharge is computed using a stage-fall-discharge relationship for all storms that produce peak discharges above 1,500 ft³/s. Discharges below 1,000 ft³/s are computed or estimated following designated storm periods only. Low flow is mostly sustained by sewage effluent from Houston suburbs. Gage heights are affected by tides, backwater from Whiteoak Bayou, and other streams. Gage-height telemeter at station.

AVERAGE DISCHARGE.--8 years (water years 1936-44) unregulated, 272 ft³/s, 197,100 acre-ft/yr; 26 years (water years 1944-57, 1962-75) regulated, 274 ft³/s, 198,500 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 10,900 ft³/s Aug. 30, 1945 (gage height, 28.82 ft), at site 0.8 mi downstream at present datum; minimum daily, 1.3 ft³/s May 24, 1939, Nov. 5, 1950, occurred prior to urban development and accompanying sewage effluent releases.

EXTREMES OUTSIDE PERIOD OF RECORD.--All flood data at site 0.8 mi downstream at present datum. Maximum gage height since at least 1835, 49.0 ft Dec. 9, 1935 (discharge, 40,000 ft³/s); furnished by engineer for Harris County. Flood of May 31, 1929, reached a gage height of 43.5 ft (discharge, 19,000 ft³/s), at bridge on Capitol Avenue, affected by bridge; furnished by city of Houston.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,270 ft³/s July 9 at 1100 hours (gage height, 19.71 ft); minimum discharge not determined (affected by tides).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1986 TO SEPTEMBER 1987
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	---	---	---	1090	---	---	---	810	---	---
2	---	---	---	---	---	1240	---	---	---	1270	---	---
3	---	---	---	---	---	1390	---	---	---	523	---	---
4	---	1010	---	---	---	1280	---	---	---	---	---	---
5	---	940	---	---	---	1380	---	---	---	---	---	---
6	---	---	---	---	---	1360	---	---	---	---	---	---
7	---	---	---	---	---	730	---	---	---	---	---	---
8	---	---	---	---	---	---	---	---	---	---	---	---
9	---	---	---	---	---	---	---	---	1580	2740	---	---
10	---	---	---	---	---	---	---	---	1640	462	---	---
11	---	---	---	---	---	---	---	---	1620	---	---	---
12	1380	---	---	---	---	---	---	---	4000	---	---	---
13	1310	---	---	---	---	---	---	---	2310	---	---	---
14	530	---	150	---	---	---	---	---	538	---	---	---
15	---	---	2600	350	---	---	---	---	---	---	---	---
16	---	---	1070	1290	---	---	---	475	1080	---	---	---
17	---	---	850	1950	---	---	---	620	809	---	---	---
18	---	---	1440	710	---	---	---	---	1470	---	---	---
19	---	---	530	---	---	---	---	---	---	---	---	---
20	---	---	770	---	---	---	---	---	---	---	---	---
21	---	---	730	---	---	---	---	---	---	---	---	---
22	1070	---	2360	650	---	---	---	---	---	---	---	---
23	460	1390	3360	1360	---	---	---	---	---	---	---	---
24	---	2840	710	1540	---	---	---	---	---	---	---	---
25	---	1560	1080	1010	710	---	---	---	---	---	---	---
26	---	380	1070	---	3170	---	---	---	---	---	---	---
27	---	---	1000	---	680	---	---	---	---	---	---	---
28	---	---	940	---	420	---	---	---	---	---	---	---
29	---	---	---	---	---	---	---	524	---	---	---	---
30	---	---	---	---	---	---	---	489	1610	---	---	---
31	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL	---	---	---	---	---	---	---	---	---	---	---	---
MEAN	---	---	---	---	---	---	---	---	---	---	---	---
MAX	---	---	---	---	---	---	---	---	---	---	---	---
MIN	---	---	---	---	---	---	---	---	---	---	---	---
AC-FT	---	---	---	---	---	---	---	---	---	---	---	---

WTR YR 1987 TOTAL - MEAN - MAX - MIN - AC-FT

REFERENCE 26

LP 88-04

The State of Texas Water Quality Inventory

9th Edition 1988

Texas Water Commission

April 1988

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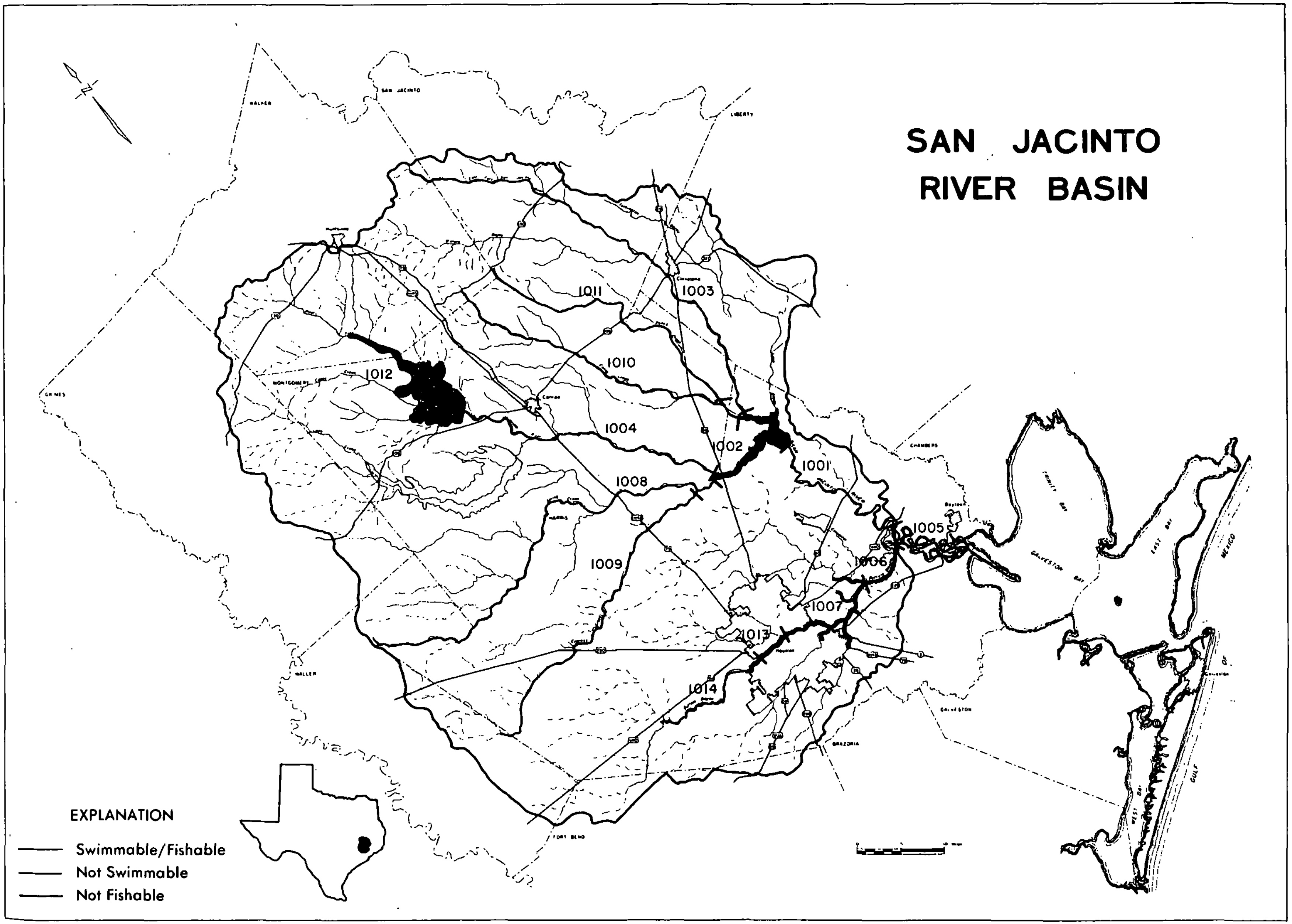

SAN JACINTO
RIVER BASIN
1001
1002
1003
1004
1005
1006
1007
1008
1009
1010
1011
1012
1013
1014
EXPLANATION
Swimmable/Fishable
Not Swimmable
Not Fishable

Segment 1013 of the San Jacinto River Basin

NAME: Buffalo Bayou Tidal

DESCRIPTION: from a point 100 meters (110 yards) upstream of US 59 in Harris County to a point 100 meters (110 yards) downstream of Shepherd Drive in Harris County

SEGMENT CLASSIFICATION AND RANK: Water Quality Limited

LENGTH: 4 miles (7 kilometers)

DESIGNATED WATER USES: Noncontact Recreation

MONITORING STATIONS: 1013.2560, 1013.2600

INTENSIVE SURVEYS:				
	03 Aug 1982	Q,F,C,L	IS-86-10	(Kirkpatrick: Dec 1986)
	09 Jul 1984	Q,F,C,L	IS-87-06	(Kirkpatrick: Apr 1987)
	25 Feb 1985	Q,F,C,L	IS-87-09	(Kirkpatrick: Jul 1987)
	15 Jul 1985	Q,X,F,C,B	IS-87-05	(Kirkpatrick: May 1987)
	13 May 1986	Q,X,F,C,R	IS-87-05	(Kirkpatrick: May 1987)

PERMITTED FACILITIES (FINAL):

Domestic	69 outfalls	76.39 MGD	7393.2 lb/d BOD
Industrial	12 outfalls	0.20 MGD	6.3 lb/d BOD
Total	81 outfalls	76.59 MGD	7399.5 lb/d BOD

KNOWN WATER QUALITY PROBLEMS/WATER QUALITY STANDARD COMPARISON:

Fecal coliform concentrations persistently exceed 2000/100 mL, and dissolved oxygen levels are sometimes less than the 2.0 mg/L criterion. This segment does not meet fishable/swimmable criteria due to depressed dissolved oxygen levels and elevated fecal coliform levels (Table 4).

POTENTIAL WATER QUALITY PROBLEMS:

Total and orthophosphorus levels are persistently elevated, and inorganic nitrogen is frequently elevated.

RELATIVE SIGNIFICANCE OF POINT AND NONPOINT SOURCE POLLUTANTS:

Point and nonpoint source discharges significantly affect water quality in this segment.

CONTROL PROGRAMS:

A. Existing: As recommended in the Houston Ship Channel Waste Load Evaluation (July 1984), the following requirements and activities have been implemented or are presently underway:

- More stringent wastewater permit requirements are in effect
- Self-reporting requirements have been expanded
- Additional intensive surveys have been conducted
- Sediment studies have been conducted
- Reaeration studies have been conducted
- Further water quality evaluations have been made
- Segment boundaries and standards criteria have been changed
- Nonpoint source studies have been conducted
- Instream aeration studies are in progress.

B. Programs still to be implemented: A use attainability analysis is in progress. Continuing intensive surveys, waste load evaluations and modeling/engineering evaluations will be conducted for the Houston Ship Channel system. Pending completion of the existing control programs, further evaluations, such as nitrifier and dispersion studies, may need to be undertaken.

FACTORS NEEDING CLARIFICATION WITH RESPECT TO CAUSE/EFFECT RELATIONSHIPS:

To be determined after the existing control programs have been studied.

KNOWN RELATIONSHIPS TO OTHER ENVIRONMENTAL PROBLEMS:

Currently being evaluated.

WATER QUALITY STATUS:

The following table presents water quality data for Segment 1013 from October 1, 1983 through September 30, 1987. Total dissolved solids were estimated by multiplying specific conductance by a factor of 0.5.

Parameter	Criterion	Number of Samples	Minimum	Maximum	Mean	Number of Values Outside Criteria	Mean Values Outside Criteria
Dissolved Oxygen (mg/L)	2.0	49	0.6	9.5	4.0	4	1.2
Temperature (F)	92.0	49	48.2	84.6	77.3	0	0
pH	6.5-9.0	24	7.0	8.4	7.8	0	0
Chloride (mg/L)	N/A	23	8	153	60	0	0
Sulfate (mg/L)	N/A	24	5	38	20	0	0
TDS (mg/L)	N/A	39	98	561	299	0	0
Fecal Coliforms (#/100 mL)	2000	24	2400	220000	11791	24	11791

Segment 1014 of the San Jacinto River Basin

NAME: Buffalo Bayou Above Tidal

DESCRIPTION: from a point 100 meters (110 yards) downstream of Shepherd Drive in Harris County to SH 6 in Harris County

SEGMENT CLASSIFICATION: Water Quality Limited

LENGTH: 24 miles (38 kilometers)

DESIGNATED WATER USES: Noncontact Recreation
Limited Quality Aquatic Habitat

MONITORING STATIONS: 1014.2700, 1014.2850

INTENSIVE SURVEYS:

02 Sep 1980	Q,X,D,F,C	IS-28	(Kirkpatrick: Mar 1982)
07 Oct 1980	Q,X,D,R	IS-28	(Kirkpatrick: Mar 1982)
03 Aug 1982	Q,F,C,L	IS-86-10	(Kirkpatrick: Dec 1986)
09 Jul 1984	Q,F,C,L	IS-87-06	(Kirkpatrick: Apr 1987)
25 Feb 1985	Q,F,C,L	IS-87-09	(Kirkpatrick: Jul 1987)
15 Jul 1985	Q,X,D,F,C,B	IS-87-05	(Kirkpatrick: May 1987)
13 May 1986	Q,X,F,C,R	IS-87-05	(Kirkpatrick: May 1987)
07 Apr 1987	Q,X,F,C		(Kirkpatrick: in preparation) South Mayde Creek

PERMITTED FACILITIES (FINAL):

Domestic	127 outfalls	170.46 MGD	14103.8 lb/d BOD
Industrial	25 outfalls	1.09 MGD	78.3 lb/d BOD
Total	152 outfalls	171.55 MGD	14182.1 lb/d BOD

KNOWN WATER QUALITY PROBLEMS/WATER QUALITY STANDARD COMPARISON:

Dissolved oxygen levels less than the criterion have been recorded. Fecal coliform bacteria frequently exceed 2000/100 mL. A portion of this segment does not meet fishable criteria due to depressed dissolved oxygen levels. The entire segment does not meet swimmable criteria due to elevated levels of fecal coliform bacteria (Table 4).

POTENTIAL WATER QUALITY PROBLEMS:

Chloride levels are occasionally elevated, and sulfate levels are elevated on rare occasions. Total and orthophosphorus levels are persistently elevated, and inorganic nitrogen levels are regularly elevated.

RELATIVE SIGNIFICANCE OF POINT AND NONPOINT SOURCE POLLUTANTS:

Point and nonpoint source discharges significantly affect water quality in this segment.

CONTROL PROGRAMS:

A. Existing: As recommended in the Houston Ship Channel Waste Load Evaluation (July 1984), the following requirements and activities have been implemented or are presently underway:

- More stringent wastewater permit requirements are in effect
- Self-reporting requirements have been expanded
- Additional intensive surveys have been conducted
- Sediment studies have been conducted
- Reaeration studies have been conducted
- Further water quality evaluations have been made
- Segment boundaries and standards criteria have been changed
- Instream aeration studies are in progress.

B. Programs still to be implemented: A use attainability analysis is in progress. Continuing intensive surveys, waste load evaluations and modeling/engineering evaluations will be conducted for the Houston Ship Channel system. Pending completion of the existing control programs, further evaluations, such as nitrifier and dispersion studies, may need to be undertaken.

FACTORS NEEDING CLARIFICATION WITH RESPECT TO CAUSE/EFFECT RELATIONSHIPS:

To be determined after the existing control programs have been studied.

KNOWN RELATIONSHIPS TO OTHER ENVIRONMENTAL PROBLEMS:
Currently being evaluated.

WATER QUALITY STATUS:

The following table presents water quality data for Segment 1014 from October 1, 1983 through September 30, 1987. Total dissolved solids were estimated by multiplying specific conductance by a factor of 0.5.

Parameter	Criterion	Number of Samples	Minimum	Maximum	Mean	Number of Values Outside Criteria	Mean Values Outside Criteria
Dissolved Oxygen (mg/L)	3.0	113	2.2	10.6	5.5	5	2.5
Temperature (F)	92.0	113	48.2	86.5	77.8	0	0
pH	6.5-9.0	68	6.6	7.9	7.5	0	0
Chloride (mg/L)	110	59	5	170	79	7	136
Sulfate (mg/L)	65	65	4	249	28	2	170
TDS (mg/L)	600	111	84	538	355	0	0
Fecal Coliforms (#/100 mL)	2000	38	10	74000	2841	27	12546

REFERENCE 27

RECORD OF COMMUNICATION

Reference 27

TYPE: Incoming Phone Call **DATE:** 5-8-92 **TIME:** 2:45 p.m.

TO: Kevin Jaynes KJaynes
Site Manager
ICF Technology Incorporated
214-979-3900

FROM: Charles Leideigh
Harris County
Engineering Division
713-620-6860

SUBJECT: West Houston Water

SUMMARY OF COMMUNICATION:

Mr. Leideigh returned my call. Mr. Leideigh stated that west Houston, within the city limits and outside of 610 Loop, was on 100% well water; inside the Loop is on surface water from Lake Houston.

H.C.MUP#57 was not listed. The well #226 on map at Harwin Drive and Willcrest is actually a City of Houston well.

The well has been tested for Arsenic because Crystal Chemical, a NPL site is located nearby. Other private wells nearby have been closed and used as monitor wells for Crystal Chemical. This system for City of Houston is technically blended but is not actually blended. The system is set up as a blended system but the surface water never reaches the areas outside of the 610 Loop.

Mr. Leideigh suggested I call the City of Houston Water Quality Branch at 713-880-2444.

Also, Memorial Villages has their own separate water system serving over 10,000 people. Their number is 713-465-8318. Mike Montgomery is the manager.

REFERENCE 28

RECORD OF COMMUNICATION

Reference 28

TYPE:	Phone Call	**DATE:**	11/30/89	**TIME:**	2:20 p.m.

TO: Kay Hodges
Chamber of Commerce
Houston, TX
(713)-651-1313

FROM: Luis Vega
FIT Biologist
ICF Technology, Inc.
Dallas, TX
(214)-744-1641

SUBJECT:

Population Density of the Houston/Harris County, TX Area

SUMMARY OF COMMUNICATION:

In a phone call with Kay Hodges of the Houston Chamber of Commerce, the following information was given:

The population of Houston, Harris County, TX in the consolidated metropolitan statistical area is 3,580,000. This includes the surrounding counties and incorporated limits covering an area of 7,422.38 square miles.

The population of Harris County only is 2,740,900.

The population of Houston, Harris County, TX in the principle metropolitan statistical area is 3,182,900, and covers an area of 5,435.48 square miles. The number of households in Houston is 1,196,700, which gives an average population per household of 2.66.

NOTE: The above information is based on the 1980 Census information.

CONCLUSIONS:

Using the data for the principle metropolitan statistical area, the population density for the Houston, Harris County, TX area is calculated as 586 persons per square mile.

3,182,900 divided by 5,435.48 square miles = 585.85 persons/square mile (586 persons).

REFERENCE 29

RECORD OF COMMUNICATION

Reference 29

TYPE: Outgoing Phone Call **DATE:** 5-8-92 **TIME:** 3:05 p.m.

TO:
Ms. Cantu
Secretary
Piney Point Elementary
Houston, TX
713-782-0130

FROM:
Kevin Jaynes
Site Manager
ICF Technology Incorporated
214-979-3900

SUBJECT: Enrollment at Piney Point Elementary

SUMMARY OF COMMUNICATION:

There are 654 students enrolled at Piney Point Elementary.

REFERENCE 30

RECORD OF COMMUNICATION

Reference 30

TYPE: Outgoing Phone Call **DATE:** 5-8-92 **TIME:** 2:10 p.m.

TO:
Judy Harris
Secretary of the Principal
Robert E. Lee High School
6529 Beverly Hill
Houston, TX
713-782-7310

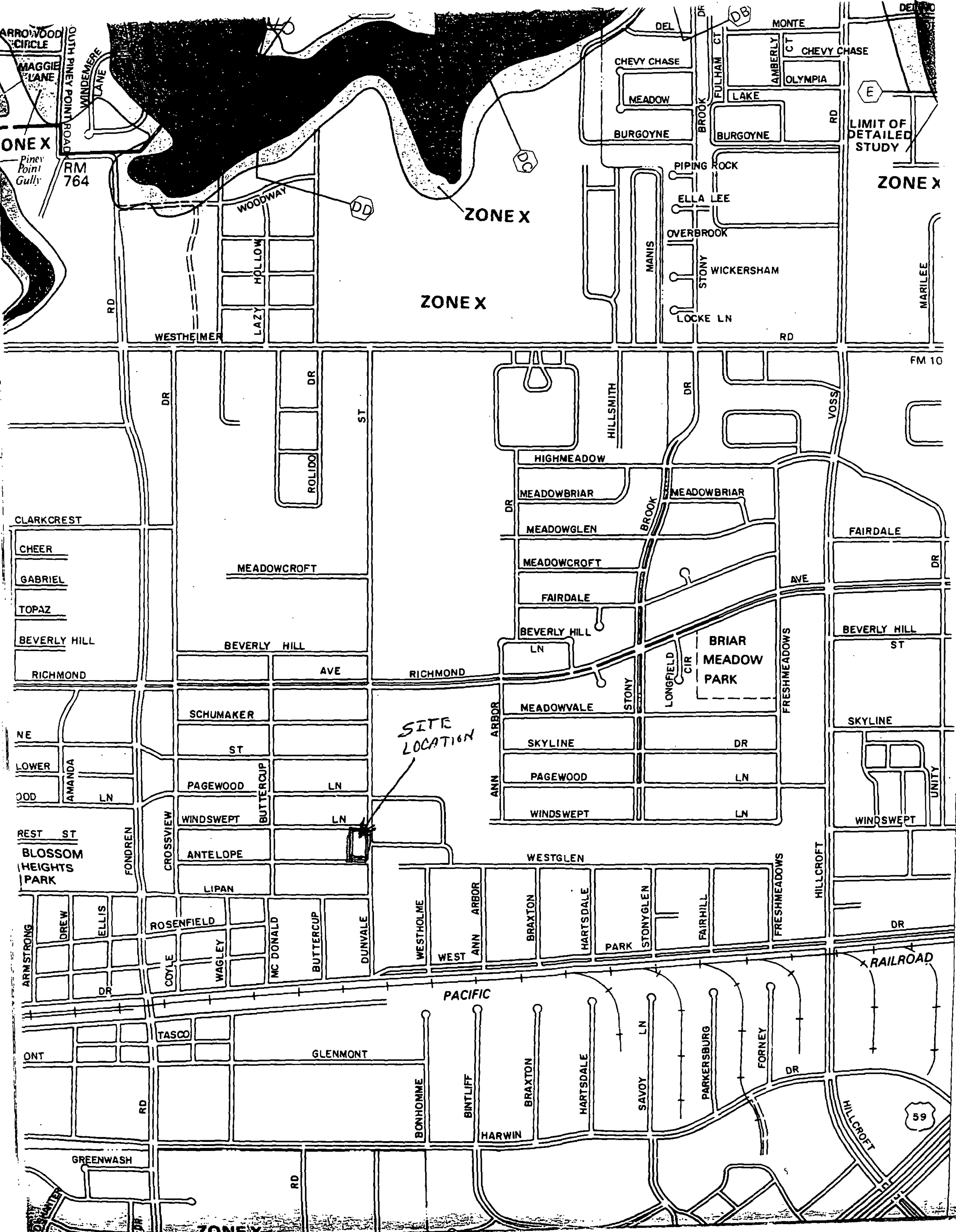
FROM:
Kevin Jaynes
Site Manager
ICF Technology Incorporated
214-979-3900

SUBJECT: Enrollment at Lee High School

SUMMARY OF COMMUNICATION:

Ms. Harris stated that current enrollment is approximately 2,500 students.

REFERENCE 31



SITE LOCATION
ZONE X
LIMIT OF DETAILED STUDY
RM 764
Piney Point Gully
WESTHEIMER
RD
FM 1093
RICHMOND
AVE
BRIAR MEADOW PARK
BLOSSOM HEIGHTS PARK
WESTGLEN
PARK
WEST
PACIFIC
RAILROAD
GLENMONT
HARWIN
GREENWASH
HILLCROFT
VOSS
FONDREN
59

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Enter the next ring distance
GEMS>

Enter program execution mode: B (batch) or I (interactive)
GEMS> i


metalcoatings
LATITUDE    29:43:49    LONGITUDE    95:30:50       1980 POPULATION
```

KM	0.00-.400	.400-.810	.810-1.60	1.60-3.20	3.20-4.80	4.80-6.40	SECTOR TOTALS
S 1	0	0	0	6873	4737	10719	22329
S 2	0	2514	0	15330	11891	12886	42621
S 3	0	0	1591	8890	24211	17089	51781
S 4	0	0	1180	8757	13168	25516	48621
S 5	0	385	2866	10371	9934	8590	32146
S 6	1171	0	2363	6586	11851	17640	39611
RING TOTALS	1171	2899	8000	56807	75792	92440	237109

```
press RETURN to continue
 Esc for ATtention, Home to SWitch    ¤      Capture Off         ¤ On: 00:08:13
```

Accessed by Kevin Jaynes 2/10/92 4:05pm -

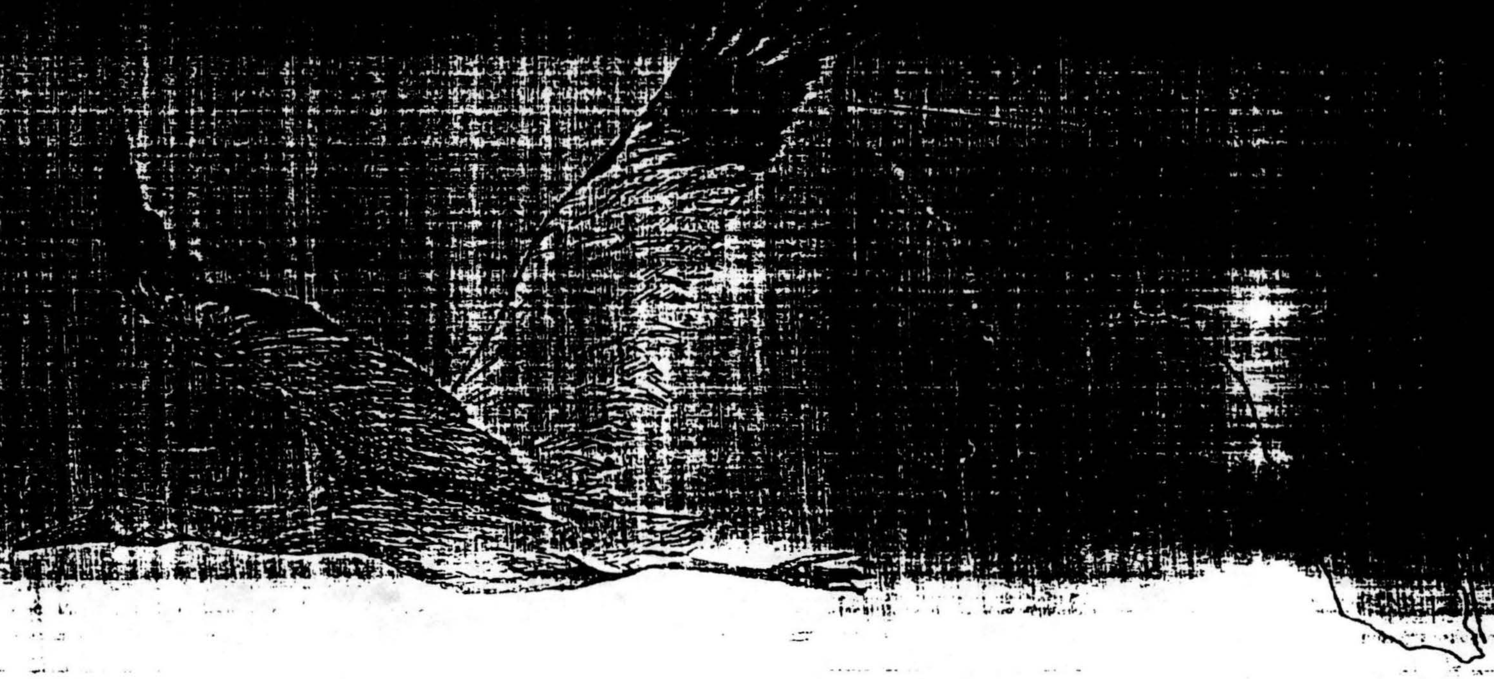
REFERENCE 32

Endangered and

pecies of

and Okla

1987



PREFACE

The Endangered Species Act was passed in 1973 to check the precipitous decline of native fish, wildlife, and plants in the United States. The U.S. Fish and Wildlife Service is charged with determining which species face extinction through man's alteration of their habitat, protecting them from further decline and providing for their continued survival. All Federal agencies are charged with using their authorities to carry out programs for the conservation of endangered species and threatened species and must ensure that any action authorized, funded, or carried out by them does not jeopardize the continued existence of any endangered or threatened species or result in the adverse modification of critical habitat of such species.

This summary of Federally listed endangered and threatened species in Texas and Oklahoma has been compiled by the Albuquerque Regional Office of the U.S. Fish and Wildlife Service. The information provided is for general knowledge only; specific data can be obtained from:

U.S. Fish and Wildlife Service
Office of Endangered Species
P.O. Box 1306
Albuquerque, New Mexico 87103
(505) 766-3972

Ecological Services Field Office
U.S. Fish & Wildlife Service
222 S. Houston, Suite A
Tulsa, Oklahoma 74127
(918) 581-7458

Ecological Services Field Office
U.S. Fish & Wildlife Service
819 Taylor Street, Rm. 9A33
Fort Worth, Texas 76102
(817) 334-2961

Ecological Services Field Office
U.S. Fish & Wildlife Service
c/o Corpus Christi State University
Campus Box 338, 6300 Ocean Drive
Corpus Christi, Texas 78412
(512) 888-3346

Ecological Services Field Office
U.S. Fish & Wildlife Service
17629 E. Camino Real, Suite 211
~~Houston~~, Texas 77058 ~~Clear Lake~~
~~(713) 229-3682~~
713 750-1700 Julie Massey

Only plants and animals that are Federally listed as endangered or threatened species have been included in this summary. In addition to these Federally listed species, Texas Parks and Wildlife Department has a list of rare species which have legal protection within State boundaries, and Oklahoma has a list of rare species. Information regarding State-listed species may be obtained from:

Texas Parks and Wildlife Department
4200 Smith School Road
Austin, Texas 78744
(512) ~~479-4800~~
389-4800

Oklahoma Department of Wildlife Conservation
1801 N. Lincoln, P.O. Box 53465
Oklahoma City, Oklahoma 73152
(405) 521-3851

TEXAS BITTERWEED.....*Hymenoxys texana*

STATUS: Endangered (51 FR 8681; 3/13/86) without critical habitat

SPECIES DESCRIPTION: This member of the sunflower family (Asteraceae) is a small, single-stemmed or branching annual reaching a height of up to 4 inches. The small heads (clusters of flowers) are 0.15-0.23 inch long with small yellowish disk flowers. Flowering occurs in late March to early April.

HABITAT: This species occurs in the northern part of the Gulf Coastal Prairie, where it is found in poorly drained saline swales (depressions) around the periphery of low natural mounds (mima mounds) in open grasslands. These mostly barren areas are sparsely vegetated and the soil is covered with a blue-green alga (*Nostoc* sp.).

DISTRIBUTION:

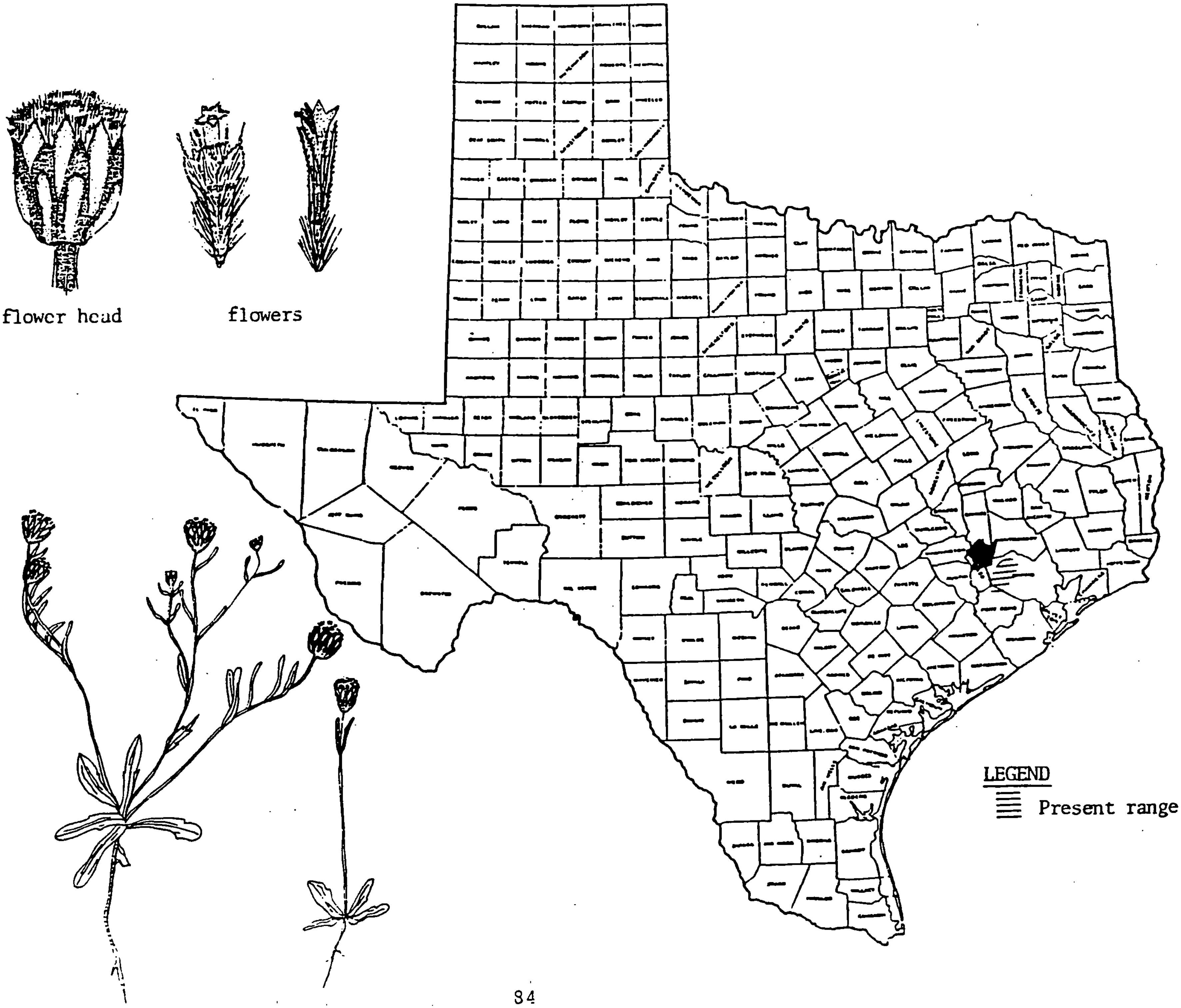
Historic: Harris County, Texas.

Present: The known populations occur in northern and western Harris County, and northern Fort Bend County.

REASONS FOR STATUS: Destruction of habitat due to residential development.

OTHER INFORMATION: Work on propagation and establishment of a botanical garden population is being being done by Mercer Arboretum, Humble, Texas. The recovery plan is being drafted. Protected by the State of Texas.

REFERENCES: Correll and Johnston 1970, Mahler 1982b.


flower head
flowers
LEGEND
Present range

REFERENCE 33

RECORD OF COMMUNICATION

Reference 33

TYPE:	Outgoing Phone Call	**DATE:**	5-12-92	**TIME:**	8:50 p.m.

TO: Mike Montgomery
Water Manager
Memorial Villages Water Authority
Houston, Texas
713-465-8318

FROM: Kevin Jaynes
Site Manager
ICF Technology, Inc.
214-979-3900

SUBJECT: Memorial Villages Water Authority, West Houston

SUMMARY OF COMMUNICATION:

The Memorial Villages Water Authority operates 6 wells with 3 plants.

Well No. 1 (b) (9) [redacted], 2 blocks south of I-10 between Campbell Road (to the west) and Brogden (to the east)

Well No. 2 (b) (9) [redacted], 2½ blocks south of I-10 between Piney Point Road (to the west) and Campbell Road (to the east)

Well No. 3 (identified as 939) (b) (9) [redacted], between Claymore and Greenbay, west of Piney Point.

Well No. 4 (b) (9) [redacted], bounded by Memorial Drive to the south and by Kuhlman to the west. 2,500 feet wouth of I-10.

Well No. 5 (b) (9) [redacted]

Well No. 6 (b) (9) [redacted], 1½ blocks south of I-10, bounded by Piney Point (to the east) and Echo Lane (to the west).

Water Plant #1 at Gaylord has 2 tanks and Wells #1, #2, and #6 pump to this location.

Water Plant #2 at 435 Piney Point; Wells #3 and #5 pump to it.

Water Plant #3 at 739 West Creekside; Well #4.

The system is interconnected or blended. Serving Hedwig Village, Hunter Creek Village, and Piney Point Village. The system is a 100% ground water system.

Bunker Hill village operates their own system. Call David Eby, City Administrator, 713-467-9762.

All the Memorial Village wells tap the Evangeline Aquifer and average 1,400 feet in depth.

Total population served from 1990 census is 10,028 with 3,045 connections as of April 1992.

Flow Quantities: for May 1, 1991 to April 30, 1992

Total: 1,047,378,000 gallons

#1 Gaylord Plant: 280,558,000 gallons

#2 Piney Point Plant: 589,957,000 gallons

#3 Creekside: 176,863,000 gallons

Pumpage per well. Concerned with 40% of total.
The three largest wells are as follows:

Well #1: 95,793,000 gallons

Well #3: 309,036,000 gallons

Well #5: 280,921,000 gallons

The remaining 3 wells usually pump less than any of these.

REFERENCE 34

RECORD OF COMMUNICATION

Reference 34

TYPE: Outgoing Phone Call **DATE:** 5-12-92 **TIME:** 2:05 p.m.

TO: David Eby
City Administrator
Bunker Hill Village
713-467-9762

FROM: Kevin Jaynes
Site Manager
ICF Technology, Inc.
214-979-3900

SUBJECT: Bunker Hill Village Municipal Water System

SUMMARY OF COMMUNICATION:

Mr. Eby stated that there are four wells, two of which are 8 inch diameter and two 6 inch diameter, average 1,200 to 1,400 feet deep screening the Evangeline Aquifer.

The system is blended or interconnected with 3,300 people served and is strictly residential. The system is a 100% ground water system.

Well #1 located at [redacted]

Well #2 and #3 located at [redacted]

Well #4 located at [redacted]

No single well produces 40% of the total water distributed.

Bunker Hill is not part of the Texas Wellhead Protection Program as yet but is planning to establish.

Summary: 3,300 people/4 wells = 825 people per well

REFERENCE 35

MITRE

26 May 1989
W52-214

Ms. Lucy Sibold
U.S. Environmental Protection Agency
401 M Street, S.W.
Room 2636, Mail Code WH-548A
Washington, D.C. 20460

Dear Ms. Sibold:

Enclosed is a copy of the draft revised HRS net precipitation values for 3,345 weather stations where data were available. The data are presented by state code, station name, latitude longitude, and net precipitation in inches. A list of state codes is also enclosed.

The net precipitation values are provided to assist the Phase II - Field Testing efforts. It is suggested that the value from the nearest weather station in a similar geographic setting be used as the net precipitation value for a site.

If there are any questions regarding this material, please contact Dave Egan at (703) 883-7866.

Sincerely,

Andrew M. Platt
Group Leader
Hazardous Waste Systems

AMP:DEE/hme

Enclosures

cc: Scott Parrish

The MITRE Corporation
Civil Systems Division
7525 Colshire Drive, McLean, Virginia 22102-3481
Telephone (703) 883-6000 Telex 248923

FIELD NAME	FIELD DEFINITION
STATE-NUMBER	Characters 1-2 Cooperative State Code for each State.

STATE CODE LISTING

01	Alabama	28	New Jersey
02	Arizona	29	New Mexico
03	Arkansas	30	New York
04	California	31	North Carolina
05	Colorado	32	North Dakota
06	Connecticut	33	Ohio
07	Delaware	34	Oklahoma
08	Florida	35	Oregon
09	Georgia	36	Pennsylvania
10	Idaho	37	Rhode Island
11	Illinois	38	South Carolina
12	Indiana	39	South Dakota
13	Iowa	40	Tennessee
14	Kansas	41	Texas
15	Kentucky	42	Utah
16	Louisiana	43	Vermont
17	Maine	44	Virginia
18	Maryland	45	Washington
19	Massachusetts	46	West Virginia
20	Michigan	47	Wisconsin
21	Minnesota	48	Wyoming
22	Mississippi	49	Not Used
23	Missouri	50	Alaska
24	Montana	51	Hawaii
25	Nebraska	66	Puerto Rico
26	Nevada	67	Virgin Islands
27	New Hampshire	91	Pacific Islands

STATION-NUMBER	Characters 3-6 Cooperative Station Number Range = 0001-9999.
DATA-CODE	Character 7 Data Indicator Code

1 = Maximum Mean Temperature
2 = Minimum Mean Temperature
3 = Average (Mean) Temperature
4 = Heating Degree Days
5 = Cooling Degree Days
6 = Precipitation (1951-80 Normals only)

OBS	STATE	NAME		LATNUM	LONNUM	NETPREC
2641	41	MC COOK		26.30	98.21	0.3647
2642	41	FALFURRIAS		27.13	98.09	1.0903
2643	41	LAREDO NO 2		27.31	99.28	0.0233
2644	41	KINGSVILLE		27.32	97.53	1.0121
2645	41	ALICE		27.44	98.04	1.6890
2646	41	CORPUS CHRISTI WSO	R	27.46	97.30	1.7390
2647	41	CORPUS CHRISTI		27.48	97.24	1.6836
2648	41	ENCINAL 3 NW		28.05	99.22	0.8944
2649	41	PORT O CONNOR		28.26	96.26	7.9240
2650	41	BEEVILLE 5 NE		28.27	97.42	3.5263
2651	41	COTULLA FAA AIRPORT		28.27	99.13	0.5928
2652	41	PORT LAVACA NO 2		28.38	96.38	8.0207
2653	41	GOLIAD		28.40	97.24	4.8189
2654	41	DILLEY		28.40	99.10	1.5284
2655	41	CRYSTAL CITY		28.41	99.50	0.3470
2656	41	MATAGORDA NO 2		28.42	95.58	9.0031
2657	41	EAGLE PASS		28.42	100.29	0.2235
2658	41	PALACIOS FAA AIRPORT		28.43	96.15	9.8209
2659	41	VICTORIA WSO	R	28.51	96.55	5.0430
2660	41	BAY CITY WATERWORKS		28.59	95.58	9.3658
2661	41	POTEET		29.02	98.35	2.8271
2662	41	DANEVANG 2 SE		29.03	96.11	7.1052
2663	41	ANGLETON 2 W		29.09	95.27	15.2626
2664	41	UVALDE		29.13	99.46	1.1524
2665	41	PIERCE 1 E		29.14	96.11	9.1547
2666	41	NEW GULF		29.16	95.55	8.4050
2667	41	NIXON		29.16	97.45	4.5676
2668	41	CHISOS BASIN		29.16	103.18	0.0000
2669	41	GALVESTON WSO	R	29.18	94.48	8.4385
2670	41	YOAKUM		29.18	97.09	5.7008
2671	41	DEL RIO WSO		29.22	100.55	0.0497
2672	41	HALLETTSVILLE		29.27	96.56	6.6609
2673	41	SAN ANTONIO WSO	R	29.32	98.28	3.7339
2674	41	PRESIDIO		29.33	104.21	0.0000
2675	41	SUGAR LAND		29.37	95.38	11.0523
2676	41	FLATONIA 2 W		29.41	97.08	7.4017
2677	41	LULING		29.41	97.40	6.6844
2678	41	NEW BRAUNFELS		29.42	98.07	6.0682
2679	41	BOERNE		29.47	98.44	5.7313
2680	41	SAN MARCOS		29.53	97.57	7.1484
2681	41	PORT ARTHUR WSO	R	29.57	94.01	16.1905
2682	41	HOUSTON INCONT AP		29.58	95.21	12.3027
2683	41	LIBERTY		30.03	94.49	17.2173
2684	41	BLANCO		30.06	98.25	7.9951
2685	41	BRENHAM		30.09	96.24	11.2405
2686	41	FREDERICKSBURG		30.16	98.52	3.0630
2687	41	AUSTIN WSO	R	30.18	97.42	5.4840
2688	41	CONROE		30.19	95.27	14.9689
2689	41	ALPINE		30.21	103.40	0.0000
2690	41	JUNCTION		30.30	99.47	1.6214
2691	41	SONORA		30.34	100.39	0.8081
2692	41	COLLEGE STATION FAA AP		30.35	96.21	10.9234
2693	41	TAYLOR		30.35	97.24	8.7022
2694	41	MOUNT LOCKE		30.40	104.00	0.0615
2695	41	HUNTSVILLE		30.43	95.33	14.0649

REFERENCE 36

TEXAS WATER COMMISSION

PROTECTING TEXANS' HEALTH AND SAFETY BY PREVENTING AND REDUCING POLLUTION

July 15, 1991

Mr. Alex Zocchi
ICF Kalser Engineers
1509 Main Street
Suite 900
Dallas, Texas 75201

Re: Texas' Wellhead Protection (WHP) Program

Dear Mr. Zocchi:

I would like to thank you for your recent inquiry on Texas' WHP Program. The program is jointly administered by the Texas Water Commission (lead agency) and the Texas Department of Health (TDH). On June 19, 1989, the State of Texas submitted its WHP program description to the Environmental Protection Agency (EPA), pursuant to Section 1428 of the Safe Drinking Water Act (SDWA), as amended in 1986. Under Section 1428, EPA is required to evaluate each State program to determine whether it is adequate to protect public water supply (PWS) wells from contaminants that may have any adverse effects on public health. On March 19, 1990, Texas' WHP Program was fully approved by EPA for the purposes of Section 1428 of the SDWA. Because the program description is approximately 300 pages long, I will be happy to provide you with highlights and requirements contained within our program description.

Designation of a restricted use area around a public drinking water well is one way of protecting underground water supplies. This area is referred to as a wellhead protection area and it is defined as the surface and subsurface area surrounding a public water well or well field through which contaminants could likely pass and eventually reach the ground water supply.

The basic concept of the program is the minimization of land use restrictions while maximizing ground water protection. To accomplish this, the Texas Water Commission (TWC) delineates WHP areas based on aquifer parameters, a five-year travel time for potential contaminants, and best professional judgement to prevent ground water contamination. The TDH reviews contingency plans for the provision of alternate water supplies in the event of contamination of the existing source. Local governments provide an inventory of all potential sources of contaminants within their WHP areas; then they implement the program. Guidance to local governments with respect to the inventory of potential contaminant sources, and other required technical assistance as needed, is provided by the TWC and the TDH.

Since Section 26.177 of the Texas Water Code requires that every city of the state having a population of 5,000 inhabitants or more establish a water pollution control and abatement program for the city which includes the inventorying and monitoring of potential contamination sources, the TWC encourages formal participation in the WHP program. Formal participation involves: 1) the TWC providing official WHP area delineations; 2) the entity conducting an inventory of all potential contaminant sources; 3) the TWC and the TDH preparing an official report which is used to brief the participating entity; 4) the entity then enacting appropriate best management practices to prohibit or control the inventoried sources which are a threat to ground water; and 5) lastly, the entity conducting a re-inventory of potential pollution sources at two to five year intervals which is provided to the sate for updating purposes.

An entity which participates in the program realizes immediate benefits in that it is assured that its ground water supply is better protected form the many potential contaminant sources. As additional incentive, those PWS systems which can demonstrate a lower risk from potential contamination may be granted reduced well monitoring requirements by the TDH.

I hope this brief overview has helped you understand how our program functions. In addition, I have enclosed a list of communities currently participating in wellhead protection. Should you have any questions, please feel free to contact me at 512/371-6332.

Sincerely,

David P. Terry, M.En.
Ground Water Section

DPT:km

Enclosure

WELLHEAD PROTECTION PROGRAM ASSESSMENT

CITY	# OF WELLS	# OF WHP AREAS	START DATE	RPT DATE
Alamo,City of	2	1	09/20/89	/ /
Alvin,City of	5	3	02/07/88	/ /
Amarillo,City of	106	0	06/07/89	/ /
Atlanta,City of	4	2	12/06/89	08/15/90
Bardwell,City of	2	1	06/06/91	/ /
Bartlett,City of	2	2	04/26/89	08/30/90
Bartonville Water Supply Corp.	4	3	09/15/89	/ /
Bay City,City of	6	5	05/04/89	08/15/90
Beaumont,City of	3	3	01/17/89	/ /
Benbrook,City of	16	10	04/02/91	/ /
Bethany Water Supply Corp	6	2	05/24/91	/ /
Bevil Oaks,City of	2	1	01/17/89	08/08/90
Brazoria,City of	3	2	01/17/89	08/30/90
Bridge City,City of	3	2	01/17/89	/ /
Bryan,City of	8	8	10/27/88	/ /
Buckholts,City of	1	1	01/17/89	08/30/90
Carrollton,City of	1	1	11/10/89	/ /
Charterwood M.U.D.	2	1	10/03/89	/ /
China,City of	3	1	01/17/89	/ /
Claude,City of	4	4	05/25/89	/ /
Clear Lake,City of	6	2	04/18/90	05/01/91
Cleveland,City of	5	3	12/01/88	/ /
Colony,The	7	4	04/22/91	/ /
Commerce,City of	7	7	04/02/91	/ /
Cumby,City of	4	1	07/05/89	08/01/90
Deer Park,City of	3	3	03/20/89	08/31/90
Del Rio,City of	4	1	10/01/86	12/01/86
Desoto,City of	1	1	05/09/91	/ /
Devine,City of	6	6	10/27/88	/ /
Dimmitt,City of	13	0	06/07/89	/ /
Dumas,City of	13	13	06/07/88	12/01/88
Eagle Bluff Assoc. Inc.	2	1	05/02/89	06/30/89
El Paso,City of	137	44	11/01/89	05/01/90
Eldorado Air Force Station	2	2	03/24/89	/ /
Fayette WSC	4	4	10/10/89	08/08/90
Flo Community WSC	3	2	10/27/88	08/08/90
Fort Bliss	14	10	01/15/90	07/20/90
Friendswood,City of	6	6	12/11/89	/ /
Friona,City of	11	3	06/07/89	/ /
Frost,City of	2	1	04/02/91	/ /
Gause,City of	1	1	01/17/89	08/31/90
George West,City of	2	1	04/16/90	/ /
Grand Prairie,City of	12	12	03/01/89	/ /
Groom,City of	2	2	07/12/88	12/01/88
Gruver,City of	2	1	06/07/89	/ /
Gunter Rural Water Supply Corp	3	2	06/06/91	/ /
Haslet,City of	3	2	06/06/91	/ /
Hereford,City of	29	0	05/17/89	/ /
Hildalgo,City of	3	1	01/17/89	/ /

WELLHEAD PROTECTION PROGRAM ASSESSMENT

CITY	# OF WELLS	# OF WHP AREAS	START DATE	RPT DATE
Houston,City of	214	0	06/06/90	/ /
Hurst,City of	6	6	10/27/88	05/25/89
Irving,City of	5	5	10/27/88	01/04/91
Jacksonville,City of	5	2	09/12/89	/ /
Johnson Co. Fresh Water Dist.1	7	3	06/06/91	/ /
Jourdanton,City of	3	3	10/27/88	/ /
Katy,City of	5	5	05/24/88	12/01/88
Keller,City of	11	6	05/09/91	/ /
Kennedale,City of	4	4	12/21/87	04/01/88
Kilgore,City of	9	9	10/27/88	/ /
Kingwood,City of	8	8	10/27/88	/ /
Kirby,City of	2	1	10/10/89	/ /
Kountze,City of	2	1	01/17/89	/ /
Kress,City of	4	2	07/19/89	/ /
Lamar I.S.D.	3	3	05/24/88	12/01/88
Lamesa,City of	8	1	10/10/89	/ /
Little Elm,Town of	8	4	04/22/91	/ /
Lumberton,City of	3	3	01/17/89	/ /
Maloy Water Supply Corporation	1	1	06/06/91	/ /
Marlow WSC	0	2	01/17/89	08/08/90
Martindale,City of	1	1	05/02/89	/ /
McLean,City of	4	4	07/12/88	12/01/88
Meeker,City of	2	1	01/17/89	/ /
Mercedes,City of	1	1	09/20/89	/ /
Midlothian,City of	2	2	05/21/91	/ /
Milano WSC	2	2	01/17/89	08/15/90
Military Highway WSC	2	2	10/10/89	/ /
Mineola,City of	3	3	10/10/89	/ /
Minerva WSC	2	2	01/17/89	08/08/90
Nash,City of	2	2	05/18/89	11/01/89
New Caney,City of	2	2	11/15/90	/ /
North Milam WSC	4	4	01/17/89	/ /
North Shore Water Supply Corp	2	2	05/09/91	/ /
Orange Grove,City of	2	2	10/27/88	02/01/90
Orange,City of	4	3	01/17/89	/ /
Ovilla Community System	2	1	04/22/91	/ /
Panhandle,City of	3	3	07/12/88	12/01/88
Panola,City of	2	2	01/17/89	/ /
Pantego,City of	6	2	05/24/91	/ /
Perryton,City of	11	11	06/07/88	12/01/88
Pinehurst,City of	2	1	01/17/89	/ /
Pinewood,City of	2	2	01/17/89	/ /
Plainview,City of	16	1	10/27/88	/ /
Pleasanton,City of	9	9	10/27/88	/ /
Porter W.S.C.	5	5	10/23/90	/ /
Poth,City of	2	2	10/27/88	08/08/90
Quail Valley Util. Dist.	4	4	10/27/88	/ /
Queen City,City of	1	1	05/15/90	08/30/90
Quitaque,City of	2	1	03/08/91	/ /

WELLHEAD PROTECTION PROGRAM ASSESSMENT

CITY	# OF WELLS	# OF WHP AREAS	START DATE	RPT DATE
Red Oak,City of	5	2	05/09/91	/ /
Redwater,City of	2	2	05/17/89	01/01/90
Refugio,City of	3	2	02/23/90	/ /
Rockdale,City of	5	5	01/17/89	08/31/90
Rocksprings,City of	2	2	10/27/88	/ /
Rosenberg,City of	5	5	05/24/88	12/01/88
Salado W.S.C.	4	1	08/23/90	/ /
San Marcos,City of	4	2	10/27/88	/ /
Shallowater,City of	7	1	04/23/90	/ /
Shenandoah,City of	2	2	10/16/90	/ /
Silsbee,City of	3	3	01/17/89	08/10/90
Sinton,City of	3	3	10/27/88	02/01/90
Skellytown,Town of	4	4	05/31/89	/ /
Smithville,City of	3	1	10/27/88	/ /
Sonora,City of	5	1	12/20/89	/ /
Sour Lake,City of	2	2	01/17/89	/ /
Southwest Milam WSC	5	5	01/17/89	08/30/90
Spearman,City of	5	3	03/07/91	/ /
Stephenville,City of	29	17	04/22/91	/ /
Sterling,City of	9	4	10/27/88	/ /
Stinnett,City of	2	0	05/18/89	/ /
Sugarland,City of	7	4	01/17/89	/ /
Sweeny,City of	3	1	09/01/89	11/01/89
Tyler,City of	13	13	10/27/88	/ /
Venus,City of	2	2	04/02/91	/ /
Victoria,City of	15	12	10/15/90	/ /
Vidor,City of	3	3	01/17/89	/ /
West Orange,City of	2	1	01/17/89	/ /
White Deer,City of	3	3	07/12/88	12/01/88
Wilmer,City of	2	2	07/11/90	/ /
*** Total ***				
	1059	444		

REFERENCE 37

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

HARRIS COUNTY, TEXAS AND INCORPORATED AREAS

PANEL 275 OF 390

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
HOUSTON, CITY OF	480296	0275	G
HUNTERS CREEK VILLAGE, CITY OF	480298	0275	G
PINEY POINT VILLAGE, CITY OF	480308	0275	G

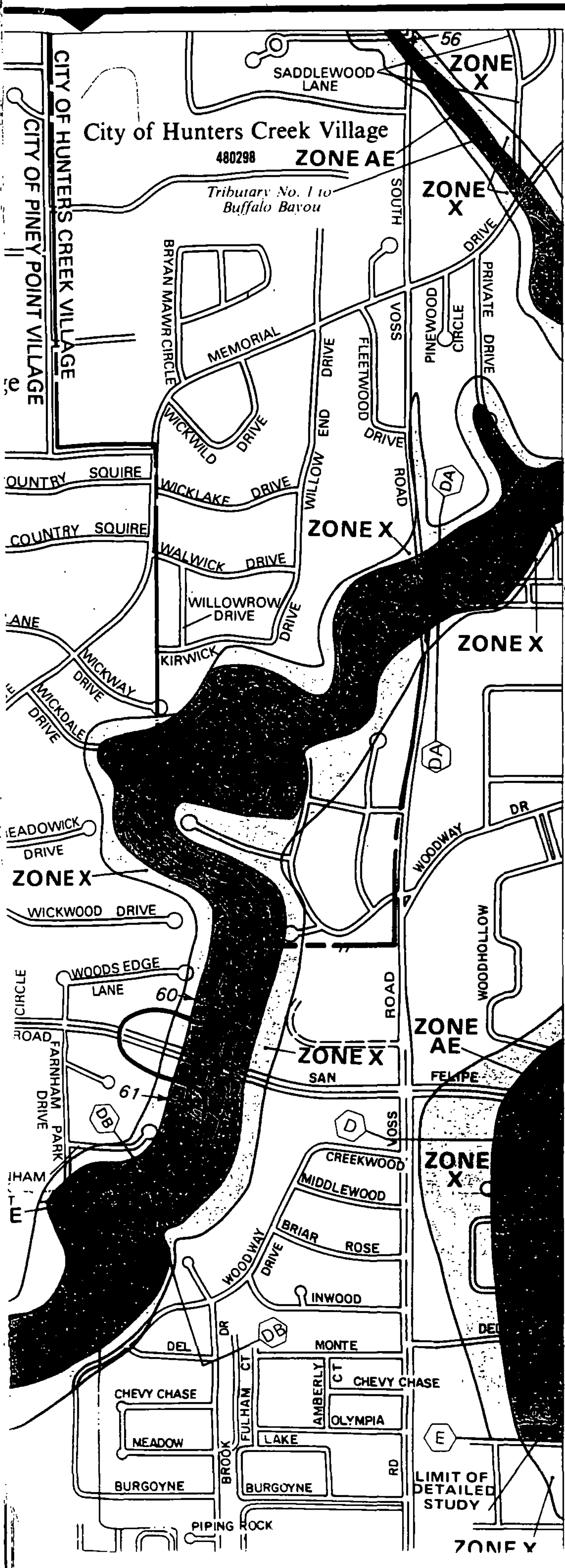
MAP NUMBER

48201C0275 G

EFFECTIVE DATE:
SEPTEMBER 28, 1990

Federal Emergency Management Agency

J



LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

ZONE A	No base flood elevations determined.
ZONE AE	Base flood elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding; velocities also determined.
ZONE A99	To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.
ZONE V	Coastal flood with velocity hazard (wave action); no base flood elevations determined.
ZONE VE	Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X	Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

ZONE X	Areas determined to be outside 500-year floodplain.
ZONE D	Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

	Floodplain Boundary
	Floodway Boundary
	Zone D Boundary
	Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.
513	Base Flood Elevation Line; Elevation in Feet*
D —— D	Cross Section Line
(EL 987)	Base Flood Elevation in Feet Where Uniform Within Zone*
RM7 X	Elevation Reference Mark
•M1.5	River Mile

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas. The community map repository should be consulted for possible updated flood hazard information prior to use of this map for property purchase or construction purposes.

Coastal base flood elevations apply only landward of 0.0 NGVD, and include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

Areas of special flood hazard (100-year flood) include Zones A, AE, AH, AO, A99, V, and VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

6-2-94
(date)

FROM: MAVA L. ELLIOTT

TO: Lonnie Ross
(SITE ASSESSMENT SECTION)

RE: TXD072 181969 – Metal Coatings Corp.

We have received a Freedom of Information inquiry concerning this site, and requestor wants copies of file(s). Records show that a confidential Site Assessment file exists for the site.

Is this file still to be considered confidential? No
(yes/no)

A prompt reply is necessary, in order that we may process this FOIA request ASAP.

THANKS!

Please note: If file material is no longer to be considered confidential, SAM/SA Chief must declassify file room material!

OMB Approval Number: 2050-0095
Approved for Use Through: 1/92

PA-Score

PA SCORESHEETS

Site Name: METAL COATINGS CORPORATION
CERCLIS ID No.: TXD072181969 ~~SC~~ DECLASSIFIED 6/2/94
Street Address: 3720 DUNVALE PER LONNIE ROSS, SAM
City/State/Zip: HOUSTON, TX 77036

Investigator: KEVIN JAYNES
Agency/Organization: MK/ICF
Street Address: 750 N. ST. PAUL SUITE 700
City/State: DALLAS, TX

Date: 7/21/92

WASTE CHARACTERISTICS

Waste Characteristics (WC) Calculations:

1 Contaminate Soil   Contaminated soil   Ref: 1,14   WQ value   maximum

Volume	6.00E+00 cu yds	2.40E-03	2.40E-03

The contaminated soil that was reported at MCC in 1988 was excavated and stored in drums. The amount stored in the facility was approximately 4 to 6 cubic yards. Analytical data of the soil revealed high concentrations of cadmium and cyanide.
Ref: 1,14

2 SWMU #1 Evaporator   Other   Ref: 1,14   WQ value   maximum

Wastestream	2.00E+04 lbs	4.00E+00	4.00E+00

SWMU #1 is a 2,000 gallon sludge evaporator tank located in the rear portion of the facility. The electroplating processes involve consecutive washes and emulsions in water, sulfuric acid, HCL acid, cyanide baths and phosphate salt solutions. Rinse waters from the tanks are removed and eventually introduced into the 2,000 gallon evaporator tank. The area around the tank has no engineered containment devices. Sludges removed from the tank are filter pressed and the remaining filter cake is disposed off-site. 200 gallons = 2,000 pounds; 10 X 2,000 gallons = 20,000 pounds.
Ref: 14

WQ total 4.00E+00

Waste Characteristics Score: WC = 18

Ground Water Pathway Criteria List
Suspected Release

Are sources poorly contained? (y/n/u)	Y
Is the source a type likely to contribute to ground water contamination (e.g., wet lagoon)? (y/n/u)	Y
Is waste quantity particularly large? (y/n/u)	N
Is precipitation heavy? (y/n/u)	Y
Is the infiltration rate high? (y/n/u)	Y
Is the site located in an area of karst terrain? (y/n)	N
Is the subsurface highly permeable or conductive? (y/n/u)	Y
Is drinking water drawn from a shallow aquifer? (y/n/u)	N
Are suspected contaminants highly mobile in ground water? (y/n/u)	Y
Does analytical or circumstantial evidence suggest ground water contamination? (y/n/u)	U

Other criteria? (y/n) Y Cadmium detected in contaminated soil

SUSPECTED RELEASE? (y/n) N

Summarize the rationale for Suspected Release:

MCC reported to the TWC in 1988 that it was in the process of removing 4 to 6 cubic yards of soil contaminated with cadmium and cyanide. Cadmium has a high ground water migration mobility. The net precipitation for the Houston area is 11.05 inches. Most municipal wells identified within 4 miles tap the Evangeline Aquifer. The Chicot and Evangeline Aquifers consist of discontinuous layers of sand, gravel and clay. The soils in the area have permeabilities of 0.06 to 0.2 inches per hour. There is no evidence to suggest the presence of karst terrain. No analytical data was found to indicate that a release to this pathway has occurred.

Ref: 1, 2, 3, 4, 5

Ground Water Pathway Criteria List
Primary Targets

Is any drinking water well nearby? (y/n/u)	N
Has any nearby drinking water well been closed? (y/n/u)	U
Has any nearby drinking water well user reported foul-testing or foul-smelling water? (y/n/u)	U
Does any nearby well have a large drawdown/high production rate? (y/n/u)	N
Is any drinking water well located between the site and other wells that are suspected to be exposed to a hazardous substance? (y/n/u)	U
Does analytical or circumstantial evidence suggest contamination at a drinking water well? (y/n/u)	U
Does any drinking water well warrant sampling? (y/n/u)	Y

Other criteria? (y/n) Y Potential due to high population on G.W.

PRIMARY TARGET(S) IDENTIFIED? (y/n) N

Summarize the rationale for Primary Targets:

The ground water pathway is of concern, due to the nature of the contaminants detected. Cadmium is considered to posses very high ground water mobility characteristics. Although, there were no municipal drinking water wells identified within 1 mile of the facility, 15 wells were identified within the 4 mile target distance limit serving approximately 87,006 people.

Ref: 6, 7, 8, 9, 10, 11

GROUND WATER PATHWAY SCORESHEETS

Pathway Characteristics		Ref.
Do you suspect a release? (y/n)	No	
Is the site located in karst terrain? (y/n)	No	2,3
Depth to aquifer (feet):	600	2,3
Distance to the nearest drinking water well (feet):	7920	12

LIKELIHOOD OF RELEASE	Suspected Release	No Suspected Release	References
1. SUSPECTED RELEASE	0		
2. NO SUSPECTED RELEASE		500	
LR =	0	500	

Targets

TARGETS	Suspected Release	No Suspected Release	References
3. PRIMARY TARGET POPULATION 0 person(s)	0		
4. SECONDARY TARGET POPULATION Are any wells part of a blended system? (y/n) Y	0	1103	
5. NEAREST WELL	0	5	
6. WELLHEAD PROTECTION AREA None within 4 Miles	0	0	
7. RESOURCES	0	5	
T =	0	1113	

WASTE CHARACTERISTICS		
WC =	0	18

GROUND WATER PATHWAY SCORE:	100

Ground Water Target Populations

Primary Target Population Drinking Water Well ID	Dist. (miles)	Population Served	Reference	Value
1 C.O.H. LJ-65-20-626	1.50	14736	8,12	147360
2 C.O.H. LJ-65-21-148	2.50	14736	8,12	147360
3 C.O.H. LJ-65-21-149	2.30	14736	8,12	147360
4 C.O.H. LJ-65-21-150	2.50	14736	8,12	147360
5 C.O.H. LJ-65-20-226	3.50	14736	8,12	147360
			Total	736800

Secondary Target Population Distance Categories	Population Served	Reference	Value
0 to 1/4 mile	0	12	0
Greater than 1/4 to 1/2 mile	0	12	0
Greater than 1/2 to 1 mile	0	12	0
Greater than 1 to 2 miles	14736	6,8	294
Greater than 2 to 3 miles	50025	10,11	678
Greater than 3 to 4 miles	22245	10,11	131
		Total	1103

Apportionment Documentation for a Blended System

The City of Houston potable water system is a blended system incorporating 216 wells and surface water. However, the west Houston area, within the city limits and outside of Loop 610 is actually on 100% ground water, while the area inside Loop 610 is on surface water. The total population of the principle metropolitan area is 3,182,900. The Memorial Village Water Authority and the Municipality of Bunker Hill Village both operate 100% ground water systems which are interconnected serving approximately 10,028 and 3,300 people, respectively. No well in any of the systems identified produce more than 40% of the total water distributed.

Ref: 6, 7, 8, 9, 10, 11, 12

Surface Water Pathway Criteria List
Suspected Release

Is surface water nearby? (y/n/u)	N
Is waste quantity particularly large? (y/n/u)	N
Is the drainage area large? (y/n/u)	U
Is rainfall heavy? (y/n/u)	Y
Is the infiltration rate low? (y/n/u)	N
Are sources poorly contained or prone to runoff or flooding? (y/n/u)	Y
Is a runoff route well defined(e.g.ditch/channel to surf.water)? (y/n/u)	Y
Is vegetation stressed along the probable runoff path? (y/n/u)	U
Are sediments or water unnaturally discolored? (y/n/u)	U
Is wildlife unnaturally absent? (y/n/u)	U
Has deposition of waste into surface water been observed? (y/n/u)	U
Is ground water discharge to surface water likely? (y/n/u)	N
Does analytical/circumstantial evidence suggest S.W. contam? (y/n/u)	Y

Other criteria? (y/n) Y Runoff from process areas to storm sewers

SUSPECTED RELEASE? (y/n) Y

Summarize the rationale for Suspected Release:

Runoff from the process area is collected in three storm sewer grates located on the concrete apron in the front of the facility. The flow of runoff is believed to enter into Buffalo Bayou via a series of street storm sewer culverts. The overland segment is approximately 1.3 miles to the Probable Point of Entry. The acreage drained by the series of storm/sanitary sewers was not determined. The two year, 24-hour rainfall potential is 4.5 to 5.0 inches. Permeability for the soil series at the site is 0.06 to 0.2 inches per hour. The runoff from the process areas could potentially be contaminated from solutions and metals used in that area.

Ref: 5, 12, 14, 15

Surface Water Pathway Criteria List
Primary Targets

Is any target nearby? (y/n/u) If yes:	Y
N Drinking water intake Y Fishery U Sensitive environment	
Has any intake, fishery, or recreational area been closed? (y/n/u)	N
Does analytical or circumstantial evidence suggest surface water contamination at or downstream of a target? (y/n/u)	Y
Does any target warrant sampling? (y/n/u) If yes:	N
N Drinking water intake U Fishery U Sensitive environment	

Other criteria? (y/n)   Y   No drinking water intakes in Buffalo Bayou

PRIMARY INTAKE(S) IDENTIFIED? (y/n)   N

Summarize the rationale for Primary Intakes:

Runoff from the process area is collected in three storm sewer grates located on the concrete apron in the front of the facility. The runoff is believed to enter Buffalo Bayou. The overland segment is approximately 1.3 miles. Electrofishing conducted by the Texas Parks and Wildlife Department in 1978 indicated the presence of some sport fish in Buffalo Bayou. The water quality of Buffalo Bayou is considered limited and is designated to for non-contact recreation. Buffalo Bayou does not meet fishable or swimmable criteria due to elevated levels of fecal coliform. Five permitted intakes were identified which are for irrigation at country clubs. No drinking water intakes were identified on Buffalo Bayou.

Ref: 12, 14, 17, 18, 19, 20

continued -------

continued -------

Other criteria? (y/n) Y Coliform contamination of Buffalo Bayou

PRIMARY FISHERY(IES) IDENTIFIED? (y/n) N

Summarize the rationale for Primary Fisheries:

The average flow of Buffalo Bayou is approximately 274 cubic feet per second. The water quality of Buffalo Bayou is considered limited and is designated for non-contact recreation. Buffalo Bayou does not meet fishable or swimmable criteria due to elevated levels of fecal coliform. Electrofishing conducted by the Texas Parks and Wildlife Department in 1978 indicated the presence of some sport fish. Little evidence of fishing was observed.

Ref: 17, 18, 19, 20

Other criteria? (y/n) Y Coliform contamination of Buffalo Bayou

PRIMARY SENSITIVE ENVIRONMENT(S) IDENTIFIED? (y/n) N

Summarize the rationale for Primary Sensitive Environments:

No wetlands were identified within the 15-mile downstream limit of the PPE in Buffalo Bayou. The water quality of Buffalo Bayou is considered limited and is designated for non-contact recreation.

Ref: 19, 20

SURFACE WATER PATHWAY SCORESHEETS

Pathway Characteristics		Ref.
Do you suspect a release? (y/n)	Yes	
Distance to surface water (feet):	6864	12
Flood frequency (years):	>500	16
What is the downstream distance (miles) to:		
a. the nearest drinking water intake?	N.A.	17
b. the nearest fishery?	1.3	18
c. the nearest sensitive environment?	N.A.	12

LIKELIHOOD OF RELEASE	Suspected Release	No Suspected Release	References
1. SUSPECTED RELEASE	550		
2. NO SUSPECTED RELEASE		0	
LR =	550	0	

Drinking Water Threat Targets

TARGETS	Suspected Release	No Suspected Release	References
3. Determine the water body type, flow (if applicable), and number of people served by each drinking water intake.			
4. PRIMARY TARGET POPULATION 0 person(s)	0		
5. SECONDARY TARGET POPULATION Are any intakes part of a blended system? (y/n): N	0	0	
6. NEAREST INTAKE	0	0	
7. RESOURCES	5	0	
T =	5	0	

Drinking Water Threat Target Populations

Intake Name	Primary (y/n)	Water Body Type/Flow	Population Served	Ref.	Value
0 none identified	N		0		0

Total Primary Target Population Value	0
Total Secondary Target Population Value	0

Apportionment Documentation for a Blended System

There were no drinking water intakes identified in Buffalo Bayou. Ref: 17, 19, 20

Human Food Chain Threat Targets

TARGETS	Suspected Release	No Suspected Release	References
8. Determine the water body type and flow for each fishery within the target limit.			
9. PRIMARY FISHERIES	0		
10. SECONDARY FISHERIES	210	0	
T =	210	0	

Human Food Chain Threat Targets

Fishery Name	Primary (y/n)	Water Body Type/Flow	Ref.	Value
1 Buffalo Bayou	N	>100-1000 cfs	18,19	12

Total Primary Fisheries Value	0
Total Secondary Fisheries Value	12

Environmental Threat Targets

TARGETS	Suspected Release	No Suspected Release	References
11. Determine the water body type and flow (if applicable) for each sensitive environment.			
12. PRIMARY SENSITIVE ENVIRONMENTS	0		
13. SECONDARY SENSITIVE ENVIRONS.	0	0	
T =	0	0	

Environmental Threat Targets

Sensitive Environment Name	Primary (y/n)	Water Body Type/Flow	Ref.	Value
0 none identified	N		18,24	0

Total Primary Sensitive Environments Value	0
Total Secondary Sensitive Environments Value	0

Surface Water Pathway Threat Scores

Threat	Likelihood of Release(LR) Score	Targets(T) Score	Pathway Waste Characteristics (WC) Score	Threat Score LR x T x WC / 82,500
Drinking Water	550	5	18	1
Human Food Chain	550	210	18	25
Environmental	550	0	18	0

SURFACE WATER PATHWAY SCORE: 26

Soil Exposure Pathway Criteria List
Resident Population

Is any residence, school, or daycare facility on or within 200 feet of an area of suspected contamination? (y/n/u)	Y
Is any residence, school, or daycare facility located on adjacent land previously owned or leased by the site owner/operator? (y/n/u)	N
Is there a migration route that might spread hazardous substances near residences, schools, or daycare facilities? (y/n/u)	N
Have onsite or adjacent residents or students reported adverse health effects, exclusive of apparent drinking water or air contamination problems? (y/n/u)	U
Does any neighboring property warrant sampling? (y/n/u)	Y

Other criteria? (y/n) Y Cadmium and cyanide contaminated soils

RESIDENT POPULATION IDENTIFIED? (y/n) Y

Summarize the rationale for Resident Population:

There are 26 employees that work in two shifts, on call 24 hours a day. There were no residents observed living on-site, however there are residences adjacent to the property which are within 200 feet of the reported area of contamination. The site is an active industrial facility. No commercial agriculture, silviculture or commerical livestock production occurs on-site. No terrestrial sensitive environments were identified on-site. Analytical data of excavated soil revealed elevated levels of cadmium and cyanide. The site is fenced and accessibility is considered low with frequency of use restricted to employees.

Ref: 1, 14

SOIL EXPOSURE PATHWAY SCORESHEETS

Pathway Characteristics

		Ref.
Do any people live on or within 200 ft of areas of suspected contamination? (y/n)	Yes	14
Do any people attend school or daycare on or within 200 ft of areas of suspected contamination? (y/n)	Yes	12
Is the facility active? (y/n):	Yes	14

LIKELIHOOD OF EXPOSURE	Suspected Contamination	References
1. SUSPECTED CONTAMINATION LE =	550	

Targets

2. RESIDENT POPULATION 3 resident(s) 0 school/daycare student(s)	30	 14,25 14
3. RESIDENT INDIVIDUAL	50	
4. WORKERS 1 - 100	5	14
5. TERRES. SENSITIVE ENVIRONMENTS	0	
6. RESOURCES	5	
T =	90	

WASTE CHARACTERISTICS

WC = 18

RESIDENT POPULATION THREAT SCORE: 11

NEARBY POPULATION THREAT SCORE: 2

Population Within 1 Mile: 10,001 - 50,000

SOIL EXPOSURE PATHWAY SCORE: 13

Soil Exposure Pathway Terrestrial Sensitive Environments

Terrestrial Sensitive Environment Name	Reference	Value
1 None Identified	14	
Total Terrestrial Sensitive Environments Value		

Air Pathway Criteria List
Suspected Release

Are odors currently reported? (y/n/u)	Y
Has release of a hazardous substance to the air been directly observed? (y/n/u)	Y
Are there reports of adverse health effects (e.g., headaches, nausea, dizziness) potentially resulting from migration of hazardous substances through the air? (y/n/u)	U
Does analytical/circumstantial evidence suggest release to air? (y/n/u)	U

Other criteria? (y/n) Y Releases of fumes and vapors from SWMU #1

SUSPECTED RELEASE? (y/n) Y

Summarize the rationale for Suspected Release:

During the on-site reconnaissance inspection, vapors and fumes were observed releasing from the 2,000 gallon evaporator tank. The tank has no air control devices. There is the potential for harmful and toxic vapors to be emitted from this tank. The tank is used to evaporate washwater and sludges generated from the electroplating lines and could contain cyanide or acidic fumes. However, no analytical data has been obtained to support an observed release.

Ref: 14

AIR PATHWAY SCORESHEETS

Pathway Characteristics

		Ref.
Do you suspect a release? (y/n)	Yes	
Distance to the nearest individual (feet):	20	14

LIKELIHOOD OF RELEASE	Suspected Release	No Suspected Release	References
1. SUSPECTED RELEASE	550		
2. NO SUSPECTED RELEASE		0	
LR =	550	0	

Targets

TARGETS	Suspected Release	No Suspected Release	References
3. PRIMARY TARGET POPULATION 1197 person(s)	11970		
4. SECONDARY TARGET POPULATION	100	0	
5. NEAREST INDIVIDUAL	50	0	
6. PRIMARY SENSITIVE ENVIRONS.	0		
7. SECONDARY SENSITIVE ENVIRONS.	1	0	
8. RESOURCES	5	0	
T =	12126	0	

WASTE CHARACTERISTICS		
WC =	32	0

AIR PATHWAY SCORE:	100

Air Pathway Secondary Target Populations

Distance Categories	Population	References	Value
Onsite	N.A.		0
Greater than 0 to 1/4 mile	N.A.		0
Greater than 1/4 to 1/2 mile	3553	21,22	28
Greater than 1/2 to 1 mile	10500	21,23	26
Greater than 1 to 2 miles	56807	21	27
Greater than 2 to 3 miles	75792	21	12
Greater than 3 to 4 miles	92440	21	7
		Total Secondary Population Value	100

Air Pathway Primary Sensitive Environments

Sensitive Environment Name	Reference	Value
1 none identified	14	0
Total Primary Sensitive Environments Value		

Air Pathway Secondary Sensitive Environments

Sensitive Environment Name	Distance	Reference	Value
1 Hymenoxys texana,Tx Bitterweed	>1/4-1/2	24	0.5
Total Secondary Sensitive Environments Value			1

SITE SCORE CALCULATION	SCORE
GROUND WATER PATHWAY SCORE:	100
SURFACE WATER PATHWAY SCORE:	26
SOIL EXPOSURE PATHWAY SCORE:	13
AIR PATHWAY SCORE:	100
SITE SCORE:	72

SUMMARY

1. Is there a high possibility of a threat to any nearby drinking water well(s) by migration of a hazardous substance in ground water? No

   If yes, identify the well(s).

   If yes, how many people are served by the threatened well(s)? 0

2. Is there a high possibility of a threat to any of the following by hazardous substance migration in surface water?

A.	Drinking water intake	No
B.	Fishery	Yes
C.	Sensitive environment (wetland, critical habitat, others)	No

   If yes, identity the target(s).
   Buffalo Bayou located 1.3 miles north of the site.

3. Is there a high possibility of an area of surficial contamination within 200 feet of any residence, school, or daycare facility? Yes

   If yes, identify the properties and estimate the associated population(s)
   Nearest residence is within 20 feet of the site.

4. Are there public health concerns at this site that are not addressed by PA scoring considerations? No

   If yes, explain:

REFERENCE LIST

1. Letter. Waste Classification. From: M. Rountree, MCC. To: G. Davis Texas Water Commission. October 4, 1988. Attachments.

2. Digital Models for Simulation of Ground Water Hydrology of the Chicot and Evangeline Aquifers Along the Gulf Coast of Texas. Texas Dept. of Water Resources Report 289. U.S. Geological Survey. May 1985.

3. Ground Water Withdrawals and Changes in Ground Water Levels, Ground Water Quality, and Land Surface Subsidence In the Houston District, Texas, 1980-84. U.S.G.S. Water Resources Report 87-4153.

4. Letter. HRS Net Precipitation Values. From: A. Platt, MITRE Corp. To: L. Sibold, USEPA. May 26, 1988.

5. Soil Survey of Harris County TX. U.S.D.A. Soil Conservation Service in Cooperation with the Texas Ag. Experiment Station and the Harris County Flood Control District. August 1976.

6. Record of Communication. West Houston Ground Water Wells. From: K. Jaynes, ICF Tech. To: City of Houston Water Engineering Department. May 11, 1992. TXD072181969.

7. Record of Communication. West Houston Water. From: Charles Leideigh, Harris County Engineering Division. To: K. Jaynes, ICF Tech. May 8, 1992. TXD072181969.

8. Record of Communication. Population Density of the Houston/Harris County, TX Area. From: L. Vega, ICF Tech. To: Kay Hodges, Chamber of Commerce, Houston, Texas. November 30, 1989.

9. Records of Wells, Driller's Logs, Water-Level Measurements, And Chemical Analyses of Ground Water In Harris and Galveston Counties, TX 1980-1984. U.S.G.S. Open File Report 98-378. 1987.

10. Record of Communication. Memorial Villages Water Authority, West Houston. From: K. Jaynes, ICF Tech. To: Mike Montgomery, Water Mgr. May 12, 1992. TXD072181969.

11. Record of Communication. Bunker Hill Municipal Water System. From: K. Jaynes, ICF Tech. To: David Eby, City Administrator, Bunker Hill Village. May 12, 1992. TXD072181969.

12. U.S.G.S 7.5 Minute Topographic Maps. Addicks, Tx., 1982. Alief, Tx., 1982. Bellaire, Tx., 1982. Houston Heights, Tx., 1982.

13. Letter. Texas Wellhead Protection Program. From: David Terry, Texas Water Commission. To: A. Zocchi, ICF Tech. July 15, 1991.

14. Memorandum. Summary of On-site Reconnaissance Inspection. From: K. Jaynes, ICF Tech. To: File. February 6, 1992. TXD072181969.

15. Hershfield, David M. Rainfall Frequency Atlas of the United States. Technical Paper No. 40. May 1961.

16. National Flood Insurance Rate Map. Harris County and Incorporated Areas. Panel 275 of 390. Map Number 48201C0275 G. September 28, 1990.

17. Facsimile Transmission. Surface Water Permit Status. From: Arlette Capehart, Texas Water Commission. To: K. Birdsall, ICF Tech. July 8, 1991.

18. Letter. Fishery of Buffalo Bayou. From: Mark Webb, District Mgmnt. Supervisor, Texas Parks and Wildlife Dept. To: K. Birdsall, ICF Tech. July 9, 1991.

19. Water Resources Data Texas Water Year 1987. Volume 2. U.S.G.S. Water Data Report TX-87-2.

20. The State of Texas Water Quality Inventory, 9th Edition 1988. Texas Water Commission. April 1988.

21. U.S.E.P.A. Geographical Exposure Modeling System (GEMS) database. Compiled from U.S. Census Bureau 1980 data, accessed February 10, 1992.

22. Record of Communication. Enrollment at Piney Point Elementary. From: K. Jaynes, ICF Tech. To: Ms. Cantu, Secretary, Piney Point Elementary May 8, 1992. TXD072181969.

23. Record of Communication. Enrollment at Lee High School. From: K. Jaynes, ICF Tech. To: Judy Harris, Secretary, Lee High School. May 8, 1992. TXD072181969.

24. Endangered and Threatened Species of Texas and Oklahoma 1987. U.S. Fish and Wildlife Service.

25. Record of Communication. Population Density of Houston/Harris County TX Area. From: L. Vega, ICF Tech. To: Kay Hodges, Chamber of Commerce Houston, TX. November 30, 1989.

OMB Approval Number: 2050-0095
Approved for Use Through: 1/92

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT FORM	IDENTIFICATION	
	State: TX	CERCLIS Number: TXD072181969
	CERCLIS Discovery Date: 11/17/80	

1. General Site Information

Name: METAL COATINGS CORPORATION		Street Address: 3720 DUNVALE			
City: HOUSTON	State: TX	Zip Code: 77036	County: HARRIS	Co. Code:	Cong. Dist: 7
Latitude: 29° 43' 49.0" Longitude: 95° 30' 50.0"	Approx. Area of Site: 3 acres		Status of Site: Active		

2. Owner/Operator Information

Owner: MIKE ROUNTREE			Operator: SAME		
Street Address: 3720 DUNVALE			Street Address:		
City: HOUSTON			City:		
State: TX	Zip Code: 77036	Telephone: 713-977-0123	State:	Zip Code:	Telephone:
Type of Ownership: Private			How Initially Identified: RCRA/CERCLA Notification		

<table>
<tr><td colspan="3" rowspan="3">POTENTIAL HAZARDOUS

WASTE SITE

PRELIMINARY ASSESSMENT FORM</td><td colspan="2">IDENTIFICATION</td></tr>
<tr><td>State:
TX</td><td>CERCLIS Number:
TXD072181969</td></tr>
<tr><td colspan="2">CERCLIS Discovery Date:
11/17/80</td></tr>
</table>

3. Site Evaluator Information		
Name of Evaluator: KEVIN JAYNES	Agency/Organization: MK/ICF	Date Prepared: 7/21/92
Street Address: 750 N. ST. PAUL SUITE 700	City: DALLAS	State: TX
Name of EPA or State Agency Contact: LONNIE ROSS	Telephone: 214-655-6740	
Street Address: 1445 ROSS AVENUE	City: DALLAS	State: TX

4. Site Disposition (for EPA use only)		
Emergency Response/Removal Assessment Recommendation: No Date:	CERCLIS Recommendation: Higher Priority SI Date:	Signature: Name: Position:

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT FORM	IDENTIFICATION	
	State: TX	CERCLIS Number: TXD072181969
	CERCLIS Discovery Date: 11/17/80	

5. General Site Characteristics

Predominant Land Uses Within 1 Mile of Site:	Site Setting:	Years of Operation:
Industrial Commercial Residential	Urban	Beginning Year: 1974 Ending Year: 2001

Type of Site Operations:	
Manufacturing Metal Coatings, Plating, Engraving RCRA Small Quantity Generator	Waste Generated: Onsite
	Waste Deposition Authorized By: Present Owner
	Waste Accessible to the Public: No
	Distance to Nearest Dwelling, School, or Workplace: 20 Feet

6. Waste Characteristics Information

Source Type	Quantity	Tier
Contaminated soil	6.00e+00 cu yds	V
Other	2.00e+04 lbs	W

Tier Legend
C = Constituent W = Wastestream
V = Volume A = Area

General Types of Waste:
- Metals
- Organics
- Inorganics
- Solvents
- Paints/Pigments
- Acids/Bases

Physical State of Waste as Deposited
- Solid
- Liquid
- Sludge

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT FORM	IDENTIFICATION	
	State: TX	CERCLIS Number: TXD072181969
	CERCLIS Discovery Date: 11/17/80	

7. Ground Water Pathway

Is Ground Water Used for Drinking Water Within 4 Miles: Yes Type of Ground Water Wells Within 4 Miles: Municipal	Is There a Suspected Release to Ground Water: No	List Secondary Target Population Served by Ground Water Withdrawn From: 0 - 1/4 Mile 0 >1/4 - 1/2 Mile 0 >1/2 - 1 Mile 0 >1 - 2 Miles 14736 >2 - 3 Miles 50025 >3 - 4 Miles 22245 Total 87006
	Have Primary Target Drinking Water Wells Been Identified: No	
Depth to Shallowest Aquifer: 600 Feet Karst Terrain/Aquifer Present: No	Nearest Designated Wellhead Protection Area: None within 4 Miles	

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT FORM	IDENTIFICATION	
	State: TX	CERCLIS Number: TXD072181969
	CERCLIS Discovery Date: 11/17/80	

8. Surface Water Pathway Part 1 of 4

Type of Surface Water Draining Site and 15 Miles Downstream:	Shortest Overland Distance From Any Source to Surface Water:
Stream Other: SANITARY/STORM SEWER	6864 Feet 1.3 Miles
Is there a Suspected Release to Surface Water: Yes	Site is Located in: > 500 yr floodplain

8. Surface Water Pathway Part 2 of 4

Drinking Water Intakes Along the Surface Water Migration Path: Yes

Have Primary Target Drinking Water Intakes Been Identified: No

Secondary Target Drinking Water Intakes:

Name	Water Body/Flow(cfs)	Population Served
none identified	minimal stream/ <10	0
	Total Within 15 Miles:	0

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT FORM	IDENTIFICATION	
	State: TX	CERCLIS Number: TXD072181969
	CERCLIS Discovery Date: 11/17/80	

8. Surface Water Pathway — Part 3 of 4

Fisheries Located Along the Surface Water Migration Path: Yes

Have Primary Target Fisheries Been Identified: No

Secondary Target Fisheries:

Fishery Name	Water Body Type/Flow(cfs)
Buffalo Bayou	moderate-large stream/ >100-1000

8. Surface Water Pathway — Part 4 of 4

Wetlands Located Along the Surface Water Migration Path? (y/n) No

Have Primary Target Wetlands Been Identified? (y/n) No

Secondary Target Wetlands:
None

Other Sensitive Environments Along the Surface Water Migration Path: Yes

Have Primary Target Sensitive Environments Been Identified: No

Secondary Target Sensitive Environments:

Water Body/Flow(cfs)	Sensitive Environment Type
minimal stream/ <10	Habitat for Federally designated endanger

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT FORM	IDENTIFICATION	
	State: TX	CERCLIS Number: TXD072181969
	CERCLIS Discovery Date: 11/17/80	

9. Soil Exposure Pathway

Are People Occupying Residences or Attending School or Daycare on or Within 200 Feet of Areas of Known or Suspected Contamination: Yes
Total Resident Population: 3

Number of Workers Onsite: 1 - 100

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination: Yes

Terrestrial Sensitive Environments:

Critical habitat for Federally designated endang/threat species

10. Air Pathway

Total Population on or Within:	
Onsite	0
0 - 1/4 Mile	1197
>1/4 - 1/2 Mile	3553
>1/2 - 1 Mile	10500
>1 - 2 Miles	56807
>2 - 3 Miles	75792
>3 - 4 Miles	92440
Total	240289

Is There a Suspected Release to Air: Yes

Wetlands Located Within 4 Miles of the Site: No

Other Sensitive Environments Located Within 4 Miles of the Site: Yes

Sensitive Environments Within 1/2 Mile of the Site:

Distance	Sensitive Environment Type/Wetlands Area(acres)
0 - 1/4	Habitat for Federally designated endangered/threatened species
>1/4 - 1/2	Habitat for Federally designated endangered/threatened species

PA-SCORE

REFERENCE 1

31596

metal COATINGS CORP.

10/4/88

GLEN DAVIS
TEXAS WATER COMMISSION
P.O. BOX 13087
AUSTIN, TEXAS 78711

one time
974780
Cadmium bearing waste
VS

DEAR MR. DAVIS;
WE ARE WORKING WITH STENNIE MEADOURS OF THE DEER PARK OFFICE TO CLEAN UP A SMALL PORTION OF DIRT THAT HAS BEEN CONTAMINATED. SHE SUGGESTED I CONTACT YOU TO REQUEST CLASSIFICATION OF THIS WASTE AS CLASS II.

THE DIRT WAS CONTAMINATED WITH SPENT ACID AND CAUSTIC CLEANER SLUDGES. THE CAUSTIC CLEANER WAS USED TO REMOVE OIL FROM BOLTS AND NUTS PRIOR TO PLATING. THE ACIDS, SULFURIC AND HCL, WERE USED TO PICKLE NUTS AND BOLTS PRIOR TO PLATING.

EVIDENTLY SOME CADMIUM PLATED BOLTS HAD BEEN PICKLED, AS CADMIUM IS PRESENT IN THE CONTAMINATED SOIL. THE CITY OF HOUSTON TESTED THE SOIL AND FOUND ONLY CADMIUM TO BE OUT EP TOXICITY STANDARDS.

PLEASE, CONSIDER THIS FOR CLASS II WASTE. WE AWAIT YOUR RESPONSE TO BEGIN OUR REMOVAL OF THIS SOIL. MY PHONE NUMBER IS 713-977-0123. THANKS, FOR YOUR ASSISSTANCE.

M.H. Rountree

M.H. ROUNTREE
MGR

cc: STENNIE MEADOURS

enclosures: CITY OF HOUSTON TEST REPORTS

P.O. Box 630407 Houston, Texas 77263 (713) 977-0123

6041 /CA ~~VS~~ CR #1

CITY OF HOUSTON
Health and Human Services Department
Bureau of Laboratory Services
1115 North MacGregor • Houston, Texas 770

PHE. Dist. 8

No.- 03484

Date Received: July 15-88 Lab. No.: ________ Sample No.: ________

Received by: ________ Condition of Seals: ________ Date Sampled: 7-15-88

Sampled by: JS/MP/MR Time Sampled: ________

Photos: ______ Dye Check: ______ Flow Rate Est. ______ Flow Rate Meas. ______

Composite Hrs.: ______ Temp. ______ °F ______ °C Field pH ______ Field D. O. ______

Field Cl_2 Residual. ______ mg/l

Rainfall within 48 Hrs.: Yes No

Outfall Number: 3

From: Public Health Engineering Bureau, Acct. #100100

Sample Description: Compl #43 - Metal Coating 3700 Dunvale

Remarks: Backyard soil surface

Laboratory Analysis:

TOTAL METALS		Analyst	Date	E.P. TOXICITY		Analyst	Date
pH holding time exceeded							
2. Ag	mg/l			2a Ag	mg/l		
3. As	7.58 mg/g	Rajan	8-8-88	3a As	0.025 mg/l	Rajan	8-15-8
4. B	mg/l			4a B	mg/l		
5. Cd	510.90 µg/g	K	7/19/88	5a Cd	13.7 mg/l	K	8/2/8
6. Cr	1663.0 µg/g	Jm	7/26/88	6a Cr	0.6 mg/l	K	8/2/8
7. Cu	mg/l			7a Cu	mg/l		
8. Hg	mg/l			8a Hg	mg/l		
9. Mn	mg/l			9a Mn	mg/l		
10. Ni	mg/l			10a Ni	mg/l		
11. Pb	204. mg/l	WB	7/24/88	11a Pb	<0.5 mg/l	K	8/2/88
12. Zn	mg/l			12a Zn	mg/l		
13. Se	mg/l			~~13a Se~~ CN	mg/l		

32. Conductivity ______

Additional Lab. Information: ______ * These tests were run on a mixture of of soil and 40ml. of deionized water.

Date Reported: ______ Chemistry Lab. Supervisor: W. Bailey

Laboratory Analysis:

		Analyst	Date
33. Total Coli	/100ml		
34. Fecal Coli	/100ml		

Date Reported: ______ Bacteriological Supervisor ______

No.- 03484

City of Houston
Health and Human Services Department
Bureau of Laboratory Services
1115 North MacGregor • Houston, Texas 77030

No. 03485 PHE. Dist. 8

Date Received: July 15 - 98 Lab. No.: Sample No.:

Received by: Condition of Seals: Date Sampled: 7-15-88

Sampled by: JS/MP/MR Time Sampled:

Photos: Dye Check: Flow Rate Est. Flow Rate Meas.

Composite Hrs: Temp. °F °C Field pH Field D. O. mg/

Field Cl_2 Residual: mg/l

Rainfall within 48 Hrs.: Yes No

Outfall Number: 2

From: Public Health Engineering Bureau, Acct. #100100

Sample Description: Compl #43 Metal Coating, 3700 Dunvale

Remarks: Back yard Soil Surface

Laboratory Analysis: TOTAL METALS — E.P. TOXICITY

			Analyst	Date				Analyst	Date
pH	holding time exceeded								
1. Ag		mg/l			2a Ag		mg/l		
As	0.60	ug/g	Rajan	8-8-88	3a As	< 0.005	mg/l	Raj	8-15-88
4. B		mg/l			4a B		mg/l		
Cd	226.7	ug/g	K	7/26/88	5a Cd	9.9	mg/l	K	8/2/88
Cr	37.2	ug/g	[illegible]	7/26/88	6a Cr	0.2	mg/l	K	8/2/88
7. Cu		mg/l			7a Cu		mg/l		
8. Hg		mg/l			8a Hg		mg/l		
9. Mn		mg/l			9a Mn		mg/l		
10. Ni		mg/l			10a Ni		mg/l		
11. Pb	17.0	mg/l	WB	7/28/88	11a Pb	<0.50	mg/l	K	8/2/88
12. Zn		mg/l			12a Zn		mg/l		
13. Se		mg/l			~~13a Se~~ CN		mg/l		

*32. Conductivity units

Additional Lab. Information: * These tests were run on a mixture of 40 of soil and 40ml. of deionized water.

Date Reported: Chemistry Lab. Supervisor: W. Baker

Laboratory Analysis: Analyst Date

33. Total Coliform /100ml

34. Fecal Coliform /100ml

Date Reported: Bacteriological Supervisor:

No. 03485

Health and Human Services Departm
Bureau of Laboratory Servi
1115 North MacGregor • Houston, Texas 77

PHE. Dist. S

Date Received: July 15-88 Lab. No.: Sample No.: No.- 03486

Received by: Condition of Seals: Date Sampled: 7-15-88

Sampled by JS/MP/MR Time Sampled:

Photos. Dye Check: Flow Rate Est. Flow Rate Meas.

Composite Hrs.: Temp. °F °C Field pH Field D. O.

Field Cl_2 Residual. mg/l

Rainfall within 48 Hrs.: Yes No

Outfall Number: 1

From: Public Health Engineering Bureau, Acct. #100100

Sample Description: Compl. #43 Metal Coating - 3700 Dunvale

Remarks: Back yard soil surface

Laboratory Analysis:

TOTAL METALS		Analyst	Date	E.P. TOXICITY		Analyst	Date
pH	holding time exceeded						
1. Ag	mg/l			2a Ag	mg/l		
2. As	18.0 mg/g	Rajan	8-8-88	3a As	< 0.005 mg/l	Raj	8-15-8
4. B	mg/l			4a B	mg/l		
5. Cd	306.55 ug/g	K	7/26/88	5a Cd	6.65 mg/l	K	8/2/88
6. Cr	447.0 ug/g	K	7/26/88	6a Cr	0.1 mg/l	K	8/2/88
7. Cu	mg/l			7a Cu	mg/l		
8. Hg	mg/l			8a Hg	mg/l		
9. Mn	mg/l			9a Mn	mg/l		
10. Ni	mg/l			10a Ni	mg/l		
11. Pb	336. mg/l	WB	July 28 '88	11a Pb	<0.50 mg/l	K	8/2/8
12. Zn	mg/l			12a Zn	mg/l		
13. Se	mg/l			13a Se	mg/l		
				CN			

32. Conductivity units

Additional Lab. Information: * These tests were run on a mixture of 40 of soil and 40ml. of deionized water.

Date Reported: Chemistry Lab. Supervisor: W. Beck

Laboratory Analysis:

		Analyst	Date
33. Total Coli	/100ml		
34. Fecal Coli	/100ml		

Date Reported: Bacteriological Supervisor

No.- 03486

PA-SCORE
REFERENCE 2

Report 289

DIGITAL MODELS FOR SIMULATION OF GROUND-WATER HYDROLOGY OF THE CHICOT AND EVANGELINE AQUIFERS ALONG THE GULF COAST OF TEXAS

TEXAS DEPARTMENT OF WATER RESOURCES

May 1985

TEXAS DEPARTMENT OF WATER RESOURCES

REPORT 289

DIGITAL MODELS FOR SIMULATION OF GROUND-WATER HYDROLOGY OF THE CHICOT AND EVANGELINE AQUIFERS ALONG THE GULF COAST OF TEXAS

By

Jerry E. Carr, Walter R. Meyer,
William M. Sandeen, and Ivy R. McLane
U.S. Geological Survey

This report was prepared by the U.S. Geological Survey
under cooperative agreement with the
Texas Department of Water Resources

May 1985

DIGITAL MODELS FOR SIMULATION OF GROUND-WATER HYDROLOGY OF THE CHICOT AND EVANGELINE AQUIFERS ALONG THE GULF COAST OF TEXAS

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INTRODUCTION

Purpose and Scope of This Report

The freshwater aquifers along the Texas Gulf Coast (Figure 1) supply large quantities of water for municipal supply, industrial use, and irrigation. However, extensive development of these aquifers has resulted in large declines of water levels in wells, land-surface subsidence, and saltwater encroachment. The purpose of this study, conducted by the U.S. Geological Survey in cooperation with the Texas Department of Water Resources, was to develop a means for predicting declines in the altitudes of the potentiometric surfaces in the Chicot and Evangeline aquifers for various conditions of pumping. Because of the complexity of the hydrologic system, digital-computer models were used to simulate the declines that would result from given pumping stresses. This report discusses the hydrologic data needed to construct and calibrate the models. It also presents maps showing the observed and simulated declines in the altitudes of the potentiometric surfaces and the observed and simulated subsidence of the land surface.

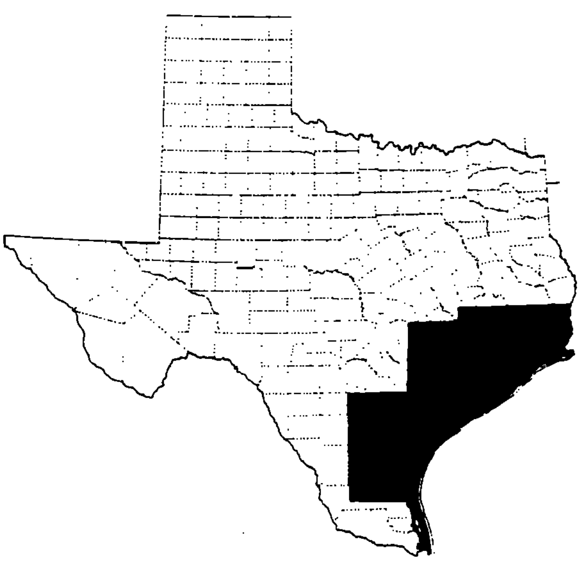

Figure 1.—Location and Extent of the Study Area

The Texas Department of Water Resources makes copies of the model and documentation available through the Texas Natural Resources Information System. Please contact the Texas Natural Resources Information System, P.O. Box 13087, Austin, Texas 78711, telephone 1-(512)-475-3321.

The study area was divided into four subregions—eastern, Houston, central, and southern. A digital-computer model was constructed and calibrated for each subregion. The coastal area was arbitrarily divided into a northern and southern region for presentation of the maps within the report. These maps show the approximate altitude of the base of the Chicot and Evangeline aquifers, the estimated transmissivities and storage coefficients of the aquifers, and the thickness of the clay beds. The modeling procedure consisted of selecting an existing computer program and modifying it to conceptually represent the hydrologic system. For each of the subregions, a generalized model (minimodel) was constructed and calibrated before constructing and calibrating a detailed model (maximodel).

For the purposes of this report, only a brief discussion of the hydrogeology is presented. For additional information on the hydrogeology of the coastal area and on the hydrologic problems related to the withdrawals of ground water, the reader is referred to the reports listed in the section "Selected References."

History of Hydrologic Modeling Along the Texas Gulf Coast

Previous hydrologic modeling along the Texas Gulf Coast was conducted for the Houston area, where the greatest amount of ground-water pumping and corresponding water-level declines have occurred. The first hydrologic model (Wood and Gabrysch, 1965) was an electric-analog model that included about 5,000 square miles (12,950 km^2) in Harris, Galveston, Brazoria, Fort Bend, Austin, Waller, Montgomery, Liberty, and Chambers Counties. This model, which was constructed on the basis of data collected since 1931, was used primarily to predict water-level declines under various conditions of pumping. This first attempt to model the ground-water system was reasonably successful, but the usefulness of the model was limited because the simulations required that the aquifers be operated independently and the results of pumping in the western part of the area could not be simulated.

The second model (Jorgensen, 1975) was an electric-analog model that incorporated additional hydrologic data and reflected more advanced concepts of the hydrologic system. These concepts included consideration of the vertical movement of water between the aquifers and the allowance for water to be derived from the clay beds. This model expanded the area of the first model to about 9,100 square miles (23,570 km^2) to minimize the boundary effects caused by long-term pumping. Jorgensen (1975) noted that additional hydrologic data and modification of the model would be needed for studies of such problems as saltwater encroachment and land-surface subsidence.

The third model (Meyer and Carr, 1979) was a digital-computer model, representing an area of 27,000 square miles (69,930 km^2), that provided an easier means of varying hydrologic properties during the calibration process. This model also was used primarily to predict water-level declines under various conditions of pumping. In general, each of the models was designed to simulate the effects of steady withdrawals of water from well fields for 1 year or longer.

Metric Conversions

Metric equivalents of "inch-pound" units of measurement are given in parentheses in the text. The "inch-pound" units may be converted to metric units by the following conversion factors:

From	Multipy by	To obtain
foot	0.3048	meter (m)
foot $^{-1}$	3.2802	meter $^{-1}$ (m^{-1})
foot per day (ft/d)	0.3048	meter per day (m/d)
foot squared per day (ft^2/d)	0.0929	meter squared per day (m^2/d)
inch per year (in/yr)	2.54	centimeter per year (cm/yr)
mile	1.609	kilometer (km)
million gallons per day	0.04381	cubic meter per seconc
square mile	2.590	square kilometer (km^2)

National Geodetic Vertical Datum of 1929 (NGVD of 1929): A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "mean sea level."

HYDROGEOLOGY OF THE TEXAS GULF COAST

The hydrogeologic units are the Chicot aquifer, Evangeline aquifer, and the Burkeville confining layer (Figures 2 and 3). These units are composed of sedimentary deposits of gravel, sand, silt, and clay. The geologic formations, from oldest to youngest, are: the Fleming Formation and Oakville Sandstone of Miocene age; the Goliad Sand of Pliocene age; the Willis Sand, Bentley Formation, Montgomery Formation, and Beaumont Clay of Pleistocene age; and alluvium of Quaternary age. The relationship between the hydrogeologic units and the geologic formations (stratigraphic units) is given in Table 1. With exception of the alluvium and the Goliad Sand, the formations crop out in belts that are nearly parallel to the shoreline of the Gulf of Mexico. The Goliad Sand is overlapped by younger formations east of the Brazos River and is not exposed at the surface in the coastal area. The younger formations crop out nearer the Gulf and the older ones farther inland. All formations thicken downdip towards the Gulf of Mexico so that the older formations dip more steeply than the younger ones. Locally, the occurrence of salt domes, faults, and folds may cause reversals of the regional dip and thickening or thinning of the formations.

PA-SCORE

REFERENCE 3

GROUND-WATER WITHDRAWALS AND CHANGES IN GROUND-WATER LEVELS, GROUND-WATER QUALITY, AND LAND-SURFACE SUBSIDENCE IN THE HOUSTON DISTRICT, TEXAS, 1980-84

U.S. GEOLOGICAL SURVEY
Water-Resources Investigations Report 87-4153

Prepared in cooperation with the
CITY OF HOUSTON and the
HARRIS-GALVESTON COASTAL SUBSIDENCE DISTRICT

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METRIC CONVERSIONS

Factors for converting inch-pound units to metric (International System) units are given in the following table:

Multiply inch-pound unit	By	To obtain metric units
acre	0.4047	hectare
acre-foot	0.001233	cubic hectometer
acre-foot per acre	0.003048	cubic hectometer per hectare
foot (ft)	0.3048	meter
foot per day (ft/d)	0.3048	meter per day
foot per year (ft/yr)	0.3048	meter per year
gallon per minute (gal/min)	0.06308	liter per second
inch (in.)	25.40	millimeter
mile (mi)	1.609	kilometer
million gallons per day (Mgal/d)	0.04381	cubic meter per second

National Geodetic Vertical Datum of 1929 (NGVD of 1929): A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "mean sea level."

INTRODUCTION

The purpose of this report is to provide information about ground-water withdrawals, changes in ground-water levels, ground-water quality, and trends in land-surface subsidence in the Houston district during 1980-84. Some data collected prior to 1980 and during the early spring of 1985 are presented to establish long-term trends and relations.

The Houston district, as described in this report, includes all of Galveston County and parts of Brazoria, Chambers, Fort Bend, Harris, Liberty, and Waller Counties (fig. 1). Many homeowners, well drillers, industrial-plant managers, and State and municipal officials provided information for this report. Financial support was provided by the city of Houston and the Harris-Galveston Coastal Subsidence District in a cooperative agreement with the U.S. Geological Survey.

GEOHYDROLOGY OF THE STUDY AREA

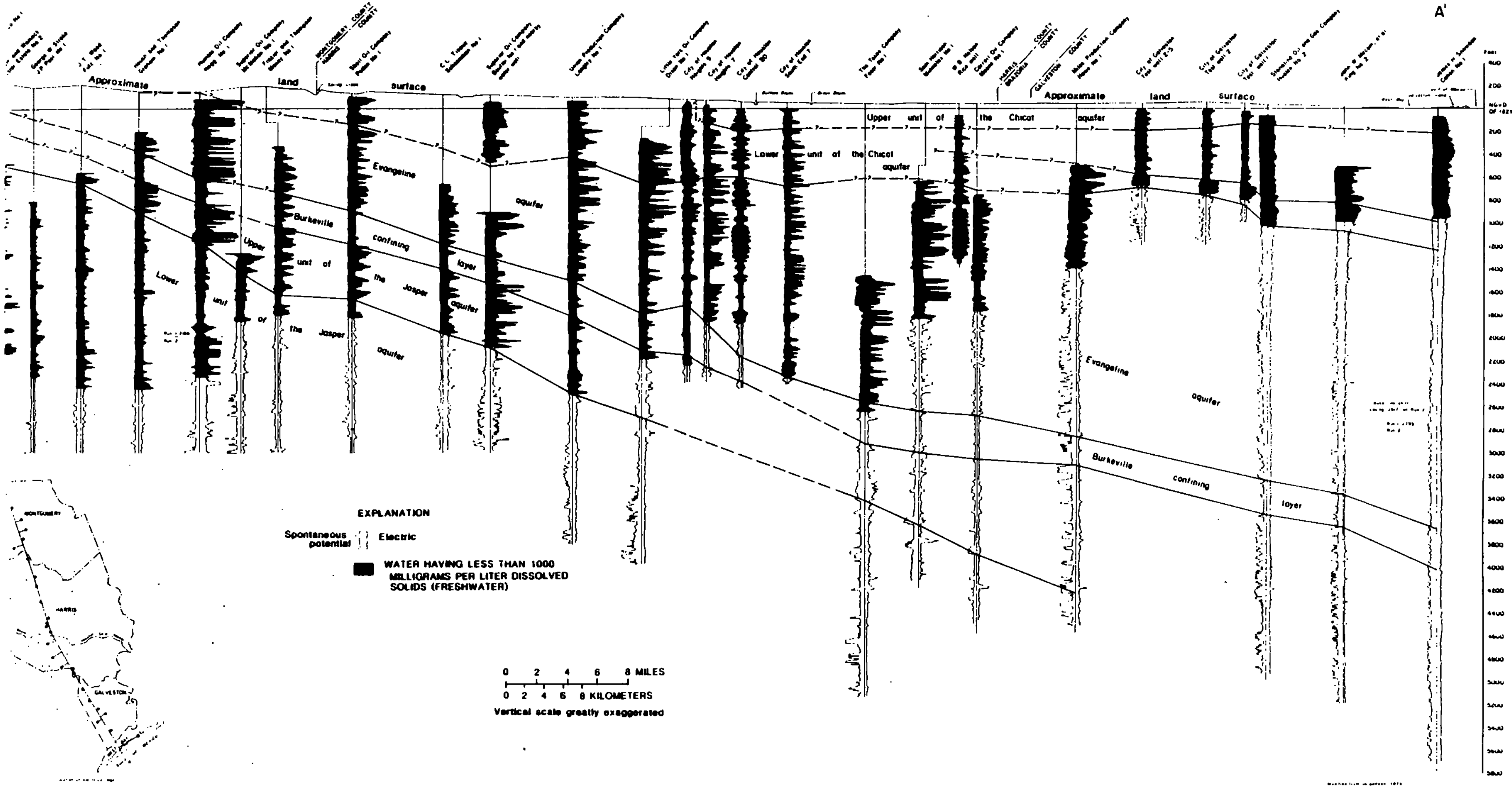
The geohydrologic units discussed in this report primarily are the Chicot and Evangeline aquifers. The Jasper aquifer also underlies the Houston district, but contains water of poor quality except in the northern part of the district. Only two wells presently are known to yield water from the Jasper aquifer in Harris County. These aquifers are composed of sedimentary deposits in the Coastal Plain physiographic province. The province is a broad plain underlain by a southeasterly thickening wedge of layered beds of clay, silt, sand, and gravel. The geologic formations in the study area are, from oldest to youngest: The Oakville Sandstone and Fleming Formation of Miocene age; the Goliad Sand of Pliocene age; the Willis Sand, Bentley Formation, Montgomery Formation, and Beaumont Formation of Pleistocene age; and alluvium of Quaternary age. The relation among the geohydrologic units and the geologic formations is given in table 1. A generalized geohydrologic section of the Chicot, Evangeline, and Jasper aquifers through Montgomery, Harris, Brazoria, and Galveston Counties is shown in figure 2.

Chicot Aquifer

The Chicot aquifer includes all deposits from the land surface to the top of the Evangeline aquifer. The Chicot aquifer is composed of the Willis Sand, Bentley Formation, Montgomery Formation, Beaumont Formation, and Quaternary alluvium. The altitude of the base of the Chicot aquifer is shown in figure 3. The discontinuous sand and clay layers of the Chicot aquifer in some parts of the study area are separated into an upper and lower unit (Jorgensen, 1975, p. 10). When the upper unit of the Chicot aquifer cannot be defined, the aquifer is undifferentiated. The Chicot aquifer is under confined conditions except in the northern part of the district. Generally, in southeastern Harris County and most of Galveston County, the Chicot aquifer contains a thick sand section that has a relatively large (as much as 75 ft/d) hydraulic conductivity (Jorgensen, 1975, p. 15). This sand unit has been intensely pumped and is known locally as the Alta Loma Sand (Alta Loma Sand of Rose, 1943). In this area, there also is another sand unit within the Chicot aquifer referred to as the middle Chicot aquifer. The Chicot aquifer is the main source of ground water in Galveston and southern Harris Counties.

Table 1.--Relations among geohydrologic units and geologic formations

<table>
<tr><th colspan="3">Geologic classification</th><th colspan="6">Geohydrologic unit</th></tr>
<tr><th>System</th><th>Series</th><th>Stratigraphic unit</th><th colspan="2">Houston district (Lang, Winslow, and White, 1950)</th><th colspan="2">Houston district (Jorgensen, 1975)</th><th colspan="2">This report</th></tr>
<tr><td rowspan="5">Quaternary</td><td>Holocene</td><td>Quaternary alluvium</td><td colspan="2">Alluvial deposits</td><td rowspan="5">Chicot aquifer</td><td rowspan="3">Upper unit</td><td rowspan="5">Chicot aquifer</td><td rowspan="3">Upper unit</td></tr>
<tr><td rowspan="4">Pleistocene</td><td>Beaumont Formation</td><td rowspan="3">Beaumont Clay</td><td rowspan="2"></td></tr>
<tr><td>Montgomery Formation</td></tr>
<tr><td>Bentley Formation</td><td>"Alta Loma Sand"</td><td rowspan="2">Lower unit</td><td rowspan="2">Lower unit
"Alta Loma Sand"</td></tr>
<tr><td>Willis Sand</td><td colspan="2">Zone 7
Zone 6</td></tr>
<tr><td rowspan="5">Tertiary</td><td rowspan="3">Pliocene</td><td rowspan="3">Goliad Sand</td><td colspan="2">Zone 5</td><td colspan="2" rowspan="3">Evangeline aquifer</td><td colspan="2" rowspan="3">Evangeline aquifer</td></tr>
<tr><td colspan="2">Zone 4</td></tr>
<tr><td colspan="2">Zone 3</td></tr>
<tr><td rowspan="2">Miocene</td><td>Fleming Formation</td><td colspan="2">Zone 2</td><td colspan="2">Burkeville confining layer</td><td colspan="2">Burkeville confining layer</td></tr>
<tr><td>Oakville Sandstone</td><td colspan="2">Zone 1</td><td colspan="2">Jasper aquifer</td><td colspan="2">Jasper aquifer</td></tr>
</table>



...on of hydrologic units from northern Montgomery County to the Gulf of Mexico.

Evangeline Aquifer

The Evangeline aquifer, composed of the Goliad Sand and the upper part of the Fleming Formation, is similar in lithology to the Chicot aquifer. One difference between the two aquifers is that the Evangeline aquifer generally has a smaller hydraulic conductivity than does the Chicot aquifer. The contrast in hydraulic conductivity and a difference in water levels are the bases for separating the Evangeline aquifer from the Chicot aquifer. The altitude of the base of the Evangeline aquifer is shown in figure 4. The Evangeline aquifer is the major source of ground water in the Houston district. In Galveston and southern Harris Counties, water in the Evangeline aquifer is saline and is not used.

Jasper Aquifer

The Jasper aquifer is composed of interbedded sand and clay layers consisting almost entirely of terrigenous clastic sediments. The approximate altitude of the top of the Jasper aquifer is shown in figure 5. Because the Jasper aquifer underlies shallower aquifers, withdrawals from the Jasper aquifer in terms of total withdrawals in Harris County are not significant. However, hydraulically it is capable of yields of as much as 3,000 gal/min to wells in adjacent Montgomery County (Baker, 1983). Only the upper part of the Jasper aquifer is utilized in Harris County.

DEVELOPMENT OF GROUND WATER

Several publications document the historical development of ground-water withdrawals in the Houston district (Wood and Gabrysch, 1965; Gabrysch, 1972, 1980, 1982; Jorgensen, 1975; Carr and others, 1985). The areas discussed in this report are Houston, Katy, Pasadena, Baytown-LaPorte, Johnson Space Center, Texas City, and Alta Loma (fig. 6).

Prior to 1977, ground water was the major source of freshwater available in the Houston district. Small quantities of surface water obtained from Lake Houston on the San Jacinto River had been available in parts of the Houston district since 1954. The city of Galveston began using surface water from Lake Houston in 1973. In late 1976, surface water from Lake Livingston on the Trinity River became available. The availability of the increased surface water caused ground-water production to decrease substantially in all areas of the Houston district except the Katy area.

In areas to the north, west, and southwest of the Houston area (fig. 6), ground-water withdrawals for public supply have steadily increased due to urban expansion and the lack of surface water. The average daily ground-water withdrawals for public supply, industrial use, and irrigation in the Houston district during 1975-84 are listed in tables 2-4.

In general, until 1977, water levels in wells in the Houston district were declining. However, during the last several years, Houston and several adjacent areas have been converting from ground water to surface water as the main water supply. With the increasing conversion from ground-water use to surface-water use, water levels in wells in the Chicot and Evangeline aquifers began to rise

Table 2.--Average daily withdrawals of ground water in Harris County and parts of Fort Bend and Waller Counties, 1975-84

Area	Use	Ground-water withdrawals (million gallons per day)									
		1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Houston	Public supply:										
	City of Houston	150.7	163.4	185.2	188.9	203.0	219.7	217.5	221.4	180.3	186.5
	Surburban	23.5	24.8	28.5	29.4	22.9	27.4	25.3	29.5	27.6	28.9
	Industry	8.1	9.0	8.0	8.1	6.9	6.7	6.2	5.2	4.1	3.0
	Irrigation	.8	.8	.8	.9	.7	1.0	.7	.9	.5	.8
	Subtotal	183.1	198.0	222.5	227.3	233.5	254.8	249.7	257.0	212.5	219.2
Katy	Public supply	11.4	15.3	24.2	29.9	31.5	43.9	49.6	64.0	62.2	74.1
	Industry	11.6	10.8	12.9	14.2	13.1	16.5	13.6	11.2	12.2	13.4
	Irrigation	110.1	104.5	84.4	109.9	82.0	97.8	98.4	94.7	40.0	62.5
	Subtotal	133.1	130.6	121.5	154.0	126.6	158.2	161.6	169.9	114.4	150.0
Pasadena	Public supply	16.3	16.7	16.9	16.6	15.1	17.6	16.6	13.8	15.8	16.2
	Industry	93.9	89.1	66.4	46.3	33.0	30.6	28.1	25.0	25.8	23.7
	Subtotal	110.2	105.8	83.3	62.9	48.1	48.2	44.7	38.8	41.6	39.9
Baytown-LaPorte	Public supply	8.5	9.3	9.8	11.4	10.6	11.1	6.8	4.8	4.3	4.4
	Industry	17.6	17.2	12.3	10.2	3.8	1.8	.9	.8	1.0	.8
	Subtotal	26.1	26.5	22.1	21.6	14.4	12.9	7.7	5.6	5.3	5.2
Johnson Space Center	Public supply	6.5	4.9	3.4	4.0	3.4	4.5	3.9	4.6	4.1	4.1
	Industry	13.6	15.6	4.0	1.0	.5	.3	.2	.3	.2	.6
	Irrigation	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
	Subtotal	20.2	20.6	7.5	5.1	4.0	4.9	4.2	5.0	4.4	4.8
Other areas in Harris County	Public supply	5.6	5.3	6.6	7.2	8.7	11.9	11.9	14.1	12.5	16.8
	Industry	--	--	--	--	.3	.1	.1	.1	.1	.1
	Irrigation	.3	.7	.8	2.3	1.3	.9	1.5	.4	.6	1.2
	Subtotal	5.9	6.0	7.4	9.6	10.3	12.9	13.5	14.6	13.2	18.1
Total		478.6	487.5	464.3	480.5	436.9	491.9	481.4	490.9	391.4	437.2

in the eastern parts of Harris County. Although this report focuses on water-level changes during 1980-84, for long-term perspective, water-level changes from 1977 to 1985 in wells in the Chicot and Evangeline aquifers are shown in figures 7 and 8; 1977 was used as the base year for determining water-level changes because most conversions from ground water to surface water were made that year. During 1977-85, the water-level changes in wells in the Chicot aquifer in the Houston district ranged from rises of as much as about 140 ft to declines of as much as about 80 ft (fig. 7). Water levels in wells in the Evangeline aquifer from 1977 to 1985 ranged from rises of as much as about 120 ft to declines of as much as about 140 ft (fig. 8).

The water-level changes in wells in the Chicot and Evangeline aquifers during 5 years, spring 1980 to spring 1985, are shown in figures 9 and 10. The altitude of water levels in wells in the Chicot and Evangeline aquifers during spring 1985 are depicted in figures 11 and 12.

Only a few wells have been completed in the Jasper aquifer in Harris County. Three of these (LJ-60-60-306, LJ-60-61-210, and LJ-65-07-905) are located in the northern part of the county and two in the western part of the county (fig. 6). The two wells (LJ-65-03-501 and LJ-65-03-505) drilled in the western part of the county were once used as a water source for a health resort. Of the three wells drilled in northern Harris County, one (LJ-60-60-306) is used for public water supply. From 1980 through 1984, this well produced about 0.26 Mgal/d of water. Water from the second well (LJ-60-61-210) in northern Harris County is used to repressure oil-producing zones. No recent water-level information is available for this well, but in 1968, the well was flowing. The U.S. Geological Survey, in cooperation with the Harris-Galveston Coastal Subsidence District, drilled the third well (LJ-65-07-905), an exploratory well, to the Jasper aquifer near the Lake Houston dam in 1979. The water level of this well was 80 ft above land surface on December 3, 1979, compared to 68 ft above land surface on December 5, 1984.

Houston Area

The Houston area, located in central and south-central Harris County, includes most of the city of Houston and several densely urbanized areas adjacent to the city. The Evangeline aquifer supplies most of the ground water used in the Houston area. Some wells in the Houston area are screened in both the Chicot and Evangeline aquifers.

Ground-Water Withdrawals

The quantity of ground water used by the city of Houston increased from 1975 through 1982 (table 5). However, since 1982, the quantity of ground water used has rapidly decreased. Ground-water contribution to the total water supply for the city of Houston during 1984 was 50.5 percent, the smallest percentage since 1978. The quantities and percentages of ground water and surface water used by the city of Houston between 1975 and 1984 are listed in table 5. For most years since 1975, ground water has supplied slightly more than 50 percent of the total water supply with a mean of 53 percent for the 10 years. During 1984, ground-water withdrawals were 186.5 Mgal/d or 50.5 percent of the total water supply. Ground-water withdrawals during 1982 were 221.4 Mgal/d, a historical high. During 1982-84, ground-water withdrawals decreased by 34.9

Table 5.--Average daily use of ground water and surface water by the city of Houston, 1975-84

Year	Use (million gallons per day) Ground water	Surface water (treated plus untreated)	Total	Percentage of ground water to total
1975	150.7	148.8	299.5	50.3
1976	163.4	175.5	338.9	48.2
1977	185.2	184.6	369.8	50.1
1978	188.9	196.1	385.0	49.1
1979	203.0	171.1	374.1	54.3
1980	219.7	174.3	394.0	55.8
1981	217.5	167.1	384.6	56.6
1982	221.4	163.7	385.1	57.5
1983	180.3	157.2	337.5	53.4
1984	186.5	183.0	369.5	50.5

Mgal/d. The total water used by Houston also has decreased from the peak of 394.0 Mgal/d during 1980 to 369.5 Mgal/d during 1984. The reduction in total water use may be related to the depressed economic conditions existing in the Houston area during the past several years (1982-84). Precipitation records indicate the decrease in water use is not due entirely to climatic conditions. The average precipitation deviation during the summer months (June, July, and August), when water use is greatest, is shown for 1976-84 in figure 13. During 1981, summer precipitation was 10 in. greater than average and the total water used by the city of Houston was 384.6 Mgal/d. During 1982, summer precipitation was 3.7 in. less than normal, but, compared to 1981, total water use only increased by 0.5 Mgal/d to 385.1 Mgal/d (table 5). During 1983, summer precipitation was 9 in. greater than average and total water use decreased to 337.5 Mgal/d (table 5). Although some decrease would be expected because of increased summer precipitation, the total water use was the smallest since 1975 (table 5). During 1984, summer precipitation was 2.1 in. less than average and total water use increased to 369.5 Mgal/d (table 5). Although this increase was substantial compared to 1983, total water use was the second smallest since 1976 (table 5).

Changes in Water Levels

Water-level changes in wells in the Chicot aquifer from spring 1980 to spring 1985 ranged from rises of as much as about 60 ft in the eastern part of the Houston area to declines of as much as about 40 ft in the southwestern part of the area. In the eastern part of the Houston area, the water level rose about 7 ft in well LJ-65-14-738 (fig. 14) from January 1980 to January 1985. The hydrograph of well LJ-65-12-801 (fig. 14), completed in the Chicot aquifer and located in the western part of the Houston area, shows a water-level decline of about 12 ft during the same time.

Water levels in wells in the Evangeline aquifer rose as much as about 60 ft in the eastern part of the Houston area from 1980 to spring 1985 due to decreased ground-water withdrawals in the Houston and Pasadena areas (fig. 10). However, water levels in wells in the Evangeline aquifer declined as much as about 60 ft (fig. 10) in the western part of the Houston area due to continued ground-water withdrawals there and increased withdrawals in the adjacent Katy area. The hydrograph of well LJ-65-21-302 (fig. 14), located just south of the center of Houston, shows a water-level rise of 33 ft from January 1980 to January 1985. However, the water level in well LJ-65-20-216 (fig. 14), in the western part of the city of Houston, declined 23 ft from January 1980 to January 1985.

During spring 1985, the altitudes of water levels in wells in the Chicot aquifer were as much as 300 ft below sea level and in wells in the Evangeline aquifer they were as much as 350 ft below sea level.

Katy Area

Parts of Harris, Fort Bend, and Waller Counties comprise the Katy area (fig. 6). The area is predominantly rural, although housing subdivisions, commercial establishments, and light industries are commonplace in the northeastern one-half of the area. In terms of economic expansion, the Katy area was the fastest growing sector of the Houston district from 1980 through 1984.

PA-SCORE
REFERENCE 4

MITRE

26 May 1989
W52-314

Ms. Lucy Sibold
U.S. Environmental Protection Agency
401 M Street, S.W.
Room 2636, Mail Code WH-548A
Washington, D.C. 20460

Dear Ms. Sibold:

Enclosed is a copy of the draft revised HRS net precipitation values for 3,345 weather stations where data were available. The data are presented by state code, station name, latitude longitude, and net precipitation in inches. A list of state codes is also enclosed.

The net precipitation values are provided to assist the Phase II Field Testing efforts. It is suggested that the value from the nearest weather station in a similar geographic setting be used as the net precipitation value for a site.

If there are any questions regarding this material, please contact Dave Egan at (703) 883-7866.

Sincerely,

Andrew M. Platt
Group Leader
Hazardous Waste Systems

AMP:DEE/hme

Enclosures

cc: Scott Parrish

The MITRE Corporation
Civil Systems Division
7525 Colshire Drive, McLean, Virginia 22102-3481
Telephone (703) 883-6000 Telex 248923

FIELD NAME	FIELD DEFINITION
STATE-NUMBER	Characters 1-2 Cooperative State Code for each State.

STATE CODE LISTING

01	Alabama	28	New Jersey
02	Arizona	29	New Mexico
03	Arkansas	30	New York
04	California	31	North Carolina
05	Colorado	32	North Dakota
06	Connecticut	33	Ohio
07	Delaware	34	Oklahoma
08	Florida	35	Oregon
09	Georgia	36	Pennsylvania
10	Idaho	37	Rhode Island
11	Illinois	38	South Carolina
12	Indiana	39	South Dakota
13	Iowa	40	Tennessee
14	Kansas	41	Texas
15	Kentucky	42	Utah
16	Louisiana	43	Vermont
17	Maine	44	Virginia
18	Maryland	45	Washington
19	Massachusetts	46	West Virginia
20	Michigan	47	Wisconsin
21	Minnesota	48	Wyoming
22	Mississippi	49	Not Used
23	Missouri	50	Alaska
24	Montana	51	Hawaii
25	Nebraska	66	Puerto Rico
26	Nevada	67	Virgin Islands
27	New Hampshire	91	Pacific Islands

STATION-NUMBER	Characters 3-6 Cooperative Station Number Range = 0001-9999.
DATA-CODE	Character 7 Data Indicator Code

1 = Maximum Mean Temperature
2 = Minimum Mean Temperature
3 = Average (Mean) Temperature
4 = Heating Degree Days
5 = Cooling Degree Days
6 = Precipitation (1951-80 Normals only)

OBS	STATE	NAME		LATNUM	LONNUM	NETPREC
2641	41	MC COOK		26.30	98.23	0.3647
2642	41	FALFURRIAS		27.13	98.09	1.0903
2643	41	LAREDO NO 2		27.31	99.28	0.0233
2644	41	KINGSVILLE		27.32	97.53	1.0121
2645	41	ALICE		27.44	98.04	1.6890
2646	41	CORPUS CHRISTI WSO	R	27.46	97.30	1.7390
2647	41	CORPUS CHRISTI		27.48	97.24	1.6836
2648	41	ENCINAL 3 NW		28.05	99.22	0.8944
2649	41	PORT O CONNOR		28.26	96.26	7.9240
2650	41	BEEVILLE 5 NE		28.27	97.42	3.5263
2651	41	COTULLA FAA AIRPORT		28.27	99.13	0.5928
2652	41	PORT LAVACA NO 2		28.38	96.38	8.0207
2653	41	GOLIAD		28.40	97.24	4.8189
2654	41	DILLEY		28.40	99.10	1.5284
2655	41	CRYSTAL CITY		28.41	99.50	0.3470
2656	41	MATAGORDA NO 2		28.42	95.58	9.0031
2657	41	EAGLE PASS		28.42	100.29	0.2235
2658	41	PALACIOS FAA AIRPORT		28.43	96.15	9.8209
2659	41	VICTORIA WSO	R	28.51	96.55	5.0430
2660	41	BAY CITY WATERWORKS		28.59	95.58	9.3658
2661	41	POTEET		29.02	98.35	2.8271
2662	41	DANEVANG 2 SE		29.03	96.11	7.1052
2663	41	ANGLETON 2 W		29.09	95.27	15.2626
2664	41	UVALDE		29.13	99.46	1.1524
2665	41	PIERCE 1 E		29.14	96.11	9.1547
2666	41	NEW GULF		29.16	95.55	8.4050
2667	41	NIXON		29.16	97.45	4.5676
2668	41	CHISOS BASIN		29.16	103.18	0.0000
2669	41	GALVESTON WSO	R	29.18	94.48	8.4385
2670	41	YOAKUM		29.18	97.09	5.7008
2671	41	DEL RIO WSO		29.22	100.55	0.0497
2672	41	HALLETTSVILLE		29.27	96.56	6.6609
2673	41	SAN ANTONIO WSO	R	29.32	98.28	3.7339
2674	41	PRESIDIO		29.33	104.21	0.0000
2675	41	SUGAR LAND		29.37	95.38	11.0523
2676	41	FLATONIA 2 W		29.41	97.08	7.4017
2677	41	LULING		29.41	97.40	6.6844
2678	41	NEW BRAUNFELS		29.42	98.07	6.0682
2679	41	BOERNE		29.47	98.44	5.7313
2680	41	SAN MARCOS		29.53	97.57	7.1484
2681	41	PORT ARTHUR WSO	R	29.57	94.01	16.1905
2682	41	HOUSTON INCONT AP		29.58	95.21	12.3027
2683	41	LIBERTY		30.03	94.49	17.2173
2684	41	BLANCO		30.06	98.25	7.9951
2685	41	BRENHAM		30.09	96.24	11.2405
2686	41	FREDERICKSBURG		30.16	98.52	3.0630
2687	41	AUSTIN WSO	R	30.18	97.42	5.4840
2688	41	CONROE		30.19	95.27	14.9689
2689	41	ALPINE		30.21	103.40	0.0000
2690	41	JUNCTION		30.30	99.47	1.6214
2691	41	SONORA		30.34	100.39	0.8081
2692	41	COLLEGE STATION FAA AP		30.35	96.21	10.9234
2693	41	TAYLOR		30.35	97.24	8.7022
2694	41	MOUNT LOCKE		30.40	104.00	0.0615
2695	41	HUNTSVILLE		30.43	95.33	14.0649

PA-SCORE

REFERENCE 5

SOIL SURVEY OF

Harris County, Texas

United States Department of Agriculture
Soil Conservation Service
In cooperation with the
Texas Agricultural Experiment Station and the
Harris County Flood Control District

Contents

Issued August 1976

Index to Soil Mapping Units

percent of the export tonnage of the Port of Houston is agricultural commodities.

The Lyndon B. Johnson Space Center is located in the southeastern part of Harris County, about 22 miles from downtown Houston. This complex was constructed in 1962 on a 1,640 acre site.

Transportation

Interstate Highway 10 and Interstate Highway 45 meet in Houston, and in addition to a freeway system, Harris County has an excellent network of state and farm-to-market highways.

The Port of Houston, which in 1972 moved more than 69 million tons of cargo, is the third largest seaport in the United States in total tonnage, according to official statistics of the U.S. Corps of Engineers. The Houston Ship Channel, a 50-mile inland waterway, connects Houston with the sea lanes of the world. Most of the channel has a minimum width of 400 feet and a depth of 40 feet.

More than 100 steamship lines offer regular service between the Port of Houston and some 250 ports of the world. Every year more than 4,000 ships call at Houston, which has more than 100 wharves in operation.

Six major rail systems operate 14 lines of mainline track radiating from the City of Houston, and two switching lines serve the industrial areas and the Port of Houston.

Natural Resources

Harris County has abundant supplies of minerals, timber, farming soil, sea water, and fresh water. Oil and gas furnish hydrocarbon compounds for refineries and chemical-petrochemical industries. Forest products from Harris County and surrounding counties support lumbering, plywood production, furniture fabrication, and paper milling. Salt and lime are also produced in the county.

The southeastern part of Harris County joins Galveston Bay for an abundant supply of sea water. The county is located atop a great underground water reservoir. A recent study indicates that the water in storage in the underground aquifer is sufficient for 250 years at a withdrawal rate of 600 million gallons daily. A dam on the San Jacinto River forms Lake Houston, which supplies Houston with 130 million gallons of surface water per day.

Climate

The climate of Harris County is predominantly marine. The terrain includes numerous small streams and bayous which, together with the nearness to Galveston Bay, favor the development of fogs. Prevailing winds are from the southeast and south, except in January when frequent high pressure areas bring invasions of polar air and prevailing northerly winds.

Temperatures are moderated by the influence of winds from the Gulf, which results in mild winters and relatively cool summer nights. Another effect of the nearness of the Gulf is abundant rainfall, except for rare extended dry periods. Polar air penetrates the area frequently enough to provide stimulating variability in the weather. Table 1 gives data on temperature and precipitation.

The average number of days with minimum temperatures of 32 degrees F. or lower is only about 7 per year at Houston and 15 at the airport. Most freezing temperatures last only a few hours because they are usually accompanied by clear skies.

Monthly rainfall is evenly distributed throughout the year. Annual rainfall has varied from 72.86 inches in 1900 to 17.66 inches in 1917. About 75 percent of the years have total precipitation between 30 and 60 inches. Monthly precipitation has ranged from 17.64 inches to only a trace. Because thundershowers are the main source of rainfall, precipitation may vary substantially in different sections of Houston on a day-to-day basis.

About one-fourth of the days each year are clear. October has the most clear days. Cloudy days are relatively frequent from November to May and partly cloudy days are more frequent from June through September. Sunshine averages near 60 percent of the possible amount for the year ranging from 46 percent in winter to 69 percent in summer. Snow is rare. However, in an occasional year several inches will fall in January or February.

Heavy fog occurs on an average of 16 days a year, and light fog occurs about 62 days a year.

Destructive windstorms are fairly infrequent, but both thundersqualls and tropical storms occasionally pass through the area.

The average date of the last temperature of 32 degrees F. or lower in spring is March 2. The average date of the first 32 degrees F. temperature in fall is November 28. The average period from the last 32 degrees F. temperature in spring to the first in fall is 271 days.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are located, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes, the size of streams and the general pattern of drainage, the kinds of native plants or crops, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has been changed very little by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are range site, Edna soil; woodland suitability group 2w9; Blackland woodland grazing group.

Bg—Bernard-Urban land complex. This is a nearly level complex in broad metropolitan areas and rural areas where the population is increasing. The areas are 40 to several hundred acres in size. The slope is 0 to 1 percent but averages 0.5 percent.

The Bernard soil makes up 30 to 80 percent of this complex, and Urban land 10 to 70 percent. Other soils, mainly Lake Charles, Addicks, Edna, and Clodine soils, make up 10 to 20 percent. The areas are so intricately mixed that it was not practical to separate them at the mapping scale for this survey. Pimple mounds are common in a few undisturbed areas of Edna and Clodine soils.

The surface layer of the Bernard soil is friable, neutral, very dark gray clay loam about 6 inches thick. The layer below that is about 48 inches thick and consists of firm, neutral, very dark gray clay in the upper part and very firm, moderately alkaline, dark gray clay in the lower part. The next layer is firm, moderately alkaline, gray clay that has distinct yellowish brown mottles and a few calcium carbonate concretions.

Urban land consists of soils that have been altered or covered by buildings and other urban structures, making classification impractical. Typical structures are single- and multiple-unit dwellings, garages, sidewalks, driveways, streets, schools, and churches. Also there are shopping centers that are less than 40 acres in size, a few single- and multiple-story office buildings, paved parking lots, and industrial sites. Open spaces within developed areas are commonly covered by 4 to 18 inches of clayey fill material. Such areas generally are adjacent to major thoroughfares, recessed streets, and larger commercial buildings. There are some areas that are less than 10 percent covered by buildings and other structures.

In general, this mapping unit has severe limitations for urban development. The major limitation is the high shrink-swell potential. Shrinking and swelling have caused driveways, patios, brick walls and ceilings to crack, sidewalks and streets to buckle, and fences to shift. Corrosivity to uncoated steel pipes is high. Landscaping is difficult, particularly in areas that have been compacted by machinery. Where exposed, the soils are sticky when wet. The soils are not suitable for use as septic tank filter fields.

Bn—Bissonnet very fine sandy loam. This is a nearly level soil in irregularly shaped, timbered areas that have smooth boundaries. The areas average 100 acres in size but some are as large as 500 acres. The surface is plane to slightly convex. The slope is 0 to 1 percent but averages 0.5 percent.

The surface layer is friable, very strongly acid, dark grayish brown very fine sandy loam about 6 inches thick. In a few places, where there are low circular pimple mounds on the surface, the surface layer is slightly thicker. The next layer is friable, very strongly acid, brown and pale brown very fine sandy loam about 22 inches thick. It tongues into the upper part of a layer that is friable, very strongly acid, light brownish gray sandy clay loam. The layer below that, extending to a depth of 70 inches, is firm, very strongly acid, gray clay loam in the upper 10 inches and firm, mildly alkaline, light gray clay loam in the lower 28 inches.

Included with this soil in mapping are small areas of Aldine, Atasco, Hockley, Segno, Wockley, and Ozan soils. These soils make up less than 15 percent of any mapped area.

This soil is used mainly for timber production and woodland grazing. Native vegetation is chiefly pine, hardwoods, sedge, beaked panicum, and little bluestem. A few small open areas are used for pasture and cultivated crops.

This soil is somewhat poorly drained. Surface runoff is slow, and the erosion hazard is slight. The available water capacity is high, and permeability is slow. During some wet seasons this soil has a perched water table, and the lower layers are saturated for 1 to 4 months.

Fertilization, liming, and careful management are needed for crops and pasture. Capability unit IIIw-1; rice group 2; pastureland and hayland group 8A; woodland suitability group 2w8; Flatwoods woodland grazing group.

Bo—Boy loamy fine sand. This soil is nearly level to gently sloping in areas along low terraces of natural drainageways. The areas are oblong and irregular and average 150 acres, but some are 700 acres in size. The surface is plane to slightly depressed or concave. The slope ranges from 0 to 2 percent but averages about 1 percent.

The surface layer is very friable, slightly acid, dark gray loamy fine sand in the upper 5 inches and very friable, strongly acid, grayish brown fine sand in the lower 4 inches. The layer below that is loose, medium acid, fine sand and extends to a depth of 56 inches. It is light yellowish brown in the upper part and very pale brown in the lower part. The next layer, extending to a depth of 75 inches, is friable, very strongly acid, light brownish gray sandy clay loam that has mottles of strong brown and red and is about 10 percent plinthite.

Included with this soil in mapping are areas of other soils that make up less than 15 percent of any mapped area. These include small areas of Kenney soils, small areas of Ozan soils in slight depressions, Hockley or Segno soils that are slightly higher on the landscape, and Voss soils that are slightly lower on the landscape.

This soil is used mainly for timber and woodland grazing. Native vegetation is loblolly pine, shortleaf pine, sweetgum, and southern red oak and an understory of sweetbay, American beautyberry, greenbriar, longleaf uniola, bull nettle, little bluestem, and blackberry vine. A few cleared areas are planted to Coastal bermudagrass, Pensacola bahiagrass, and weeping lovegrass.

This soil is somewhat poorly drained. In wet seasons, the layer that has plinthite and the material just above it are saturated for 2 to 4 months. There is no runoff in some places, and it is very slow in others. Internal films; vertical streaks of uncoated fine sand and silt 2 millimeters thick between prism faces; very strongly acid; gradual wavy boundary.

B22tg—33 to 43 inches; gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common fine and medium distinct yellowish brown (10YR 5/8) mottles and common fine prominent red mottles; weak coarse prismatic structure parting to moderate fine angular blocky; extremely hard, firm, sticky and plastic; patchy clay films; uncoated fine sand and silt coatings on faces of prisms; strongly acid; diffuse wavy boundary.

B23tg—43 to 60 inches; gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common fine prominent red mottles and few fine distinct yellowish brown mottles; weak fine angular blocky structure; extremely hard, firm, sticky and plastic; patchy clay films; medium acid.

The Ap horizon is 3 to 8 inches thick. It is very dark grayish brown, dark grayish brown, grayish brown, dark brown, or brown. It is strongly acid through slightly acid. The A&B horizon is brown, pale brown, very pale brown, yellowish brown, or light yellowish brown. Mottles are strong brown or yellowish brown. The A&B horizon is sandy loam, fine sandy loam, or very fine sandy loam. It is strongly acid through slightly acid. The B&A horizon is yellowish brown, light yellowish brown, or brownish yellow. Mottles are red, yellowish red, strong brown, light brownish gray, or light gray. The B&A horizon is clay loam, silty clay loam, or sandy clay loam. It is very strongly acid through medium acid. The B2t horizon is clay loam, silty clay loam, sandy clay, or clay. It is very strongly acid through medium acid. The matrix in the upper part of the B2t horizon is strong brown, yellowish brown, or brownish yellow. It contains mottles of red, gray, light brownish gray, or light gray. The matrix in the lower part of the B2t horizon is gray, light brownish gray, or light gray. Mottles are red, strong brown, yellowish brown, or brownish yellow. In a few places horizons below a depth of 50 inches contain a few pitted calcium carbonate concretions.

Beaumont Series

The Beaumont series consists of deep, acid, nearly level, clayey soils on upland prairies. These soils formed in thick beds of alkaline marine clay.

Undisturbed areas of these soils have gilgai microrelief, in which the microknolls are 6 to 12 inches higher than the microdepressions. When these soils are dry they have deep, wide cracks that extend to the surface. During rainstorms, water enters the cracks rapidly. When the soils are wet and the cracks are closed, water moves very slowly into the soil. Beaumont soils are poorly drained. Surface runoff and internal drainage are very slow. Permeability is very slow, and the available water capacity is high.

Some of these soils are used for rice and pasture plants. Pine and hardwood trees have encroached in a few areas. Some areas are covered by buildings and other urban structures.

Representative profile of Beaumont clay, in pasture, in the center of a microdepression, from the intersection of Red Bluff Road and Bay Area Boulevard (about 4 miles northeast of Clear Lake City), 1.0 mile northwest along Red Bluff Road, 1.35 miles north on the service road along the east side of Big Island Slough to the intersection with a pipeline, 0.3 mile east along the pipeline, and 100 feet south:

A11—0 to 9 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; common fine and medium distinct mottles of dark reddish brown (5YR 3/3); reddish brown (5YR 4/4) stains along root channels and on ped faces; moderate medium angular blocky structure; very hard, very firm, very sticky and plastic; many fine roots; common pressure faces; common black masses of partly decomposed organic matter; few shotlike iron-manganese concretions; very strongly acid; clear smooth boundary.

A12—9 to 21 inches; gray (10YR 5/1) clay, gray (10YR 6/1) dry; common fine and medium distinct dark brown (7.5YR 4/4) stains along root channels and on ped faces; moderate medium angular blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots; many shiny pressure faces; few worm casts; few black organic stains; few fine iron-mangenese concretions; very strongly acid; gradual wavy boundary.

AC1g—21 to 43 inches; gray (10YR 6/1) clay, light gray (10YR 7/1) dry; many fine and medium distinct mottles of dark brown (7.5YR 4/4); many ped faces coated with gray (10YR 5/1) clay; distinct parallelepipeds parting to moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; common coarse intersecting slickensides; many shiny pressure faces; dark brown stains along root channels; few fine iron-manganese concretions; common cracks 3 to 4 centimeters wide filled with gray (10YR 5/1) clayey material; very strongly acid; diffuse wavy boundary.

AC2g—43 to 59 inches; gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common fine distinct mottles of dark yellowish brown; distinct parallelepipeds parting to moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky and plastic; common coarse intersecting slickensides; common shiny pressure faces; few fine iron-manganese concretions; strongly acid; gradual wavy boundary.

Cg—59 to 73 inches; grayish brown (2.5Y 5/2) clay, light brownish gray (2.5Y 6/2) dry; common fine faint mottles of light olive brown and few fine distinct mottles of strong brown; weak coarse angular blocky structure; extremely hard, very firm, very sticky and plastic; few slickensides; neutral.

The A horizon is 10 to 25 inches thick. It is very dark gray, dark gray, or gray. Mottles are dark reddish brown, reddish brown, dark brown, yellowish brown, or light olive brown. The A horizon is very strongly acid through slightly acid. The ACg horizon is dark gray, gray, or light gray. Mottles are reddish brown, dark brown, dark yellowish brown, strong brown, yellowish brown, or brownish yellow. The ACg horizon is clay or silty clay. It is very strongly acid through medium acid. The Cg horizon is gray, light gray, grayish brown, or light brownish gray. Mottles are yellow or brown. The Cg horizon is clay or silty clay. It is strongly acid through mildly alkaline. In a few places calcium carbonate concretions are below a depth of 65 inches.

Bernard Series

The Bernard series consists of deep, neutral, nearly level to gently sloping, loamy soils on upland prairies. These soils have a loamy surface layer about 6 inches thick underlain by clayey lower layers (fig. 7). They formed in clayey unconsolidated sediments.

These soils are somewhat poorly drained. Surface runoff is very slow. Internal drainage is slow to very slow. Permeability is very slow, and the available water capacity is high.

These soils are used mainly for row crops, improved pasture, and native pasture. A large area is covered by buildings and other urban structures.

Representative profile of Bernard clay loam, in a field, from intersection of Cook Road and Alief Road in Alief, 1.11 miles west along Alief Road, 0.96 mile south on Synott Road, and 80 feet west:

Ap—0 to 6 inches; very dark gray (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; moderate medium granular structure; very hard, friable; many fine roots; common fine pores; common worm casts; few shotlike iron-manganese concretions; neutral; clear smooth boundary.

B1g—6 to 18 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; very hard, firm; common fine roots; common fine pores; patchy clay films; few shotlike iron-manganese concretions; neutral; gradual wavy boundary.

B21tg—18 to 34 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium and coarse blocky structure; few slickensides that do not intersect; extremely hard, very firm, sticky and plastic; few very fine pores; clay films on ped surfaces; few shotlike iron-manganese concretions; mildly alkaline; noncalcareous in matrix; diffuse wavy boundary.

B22tg—34 to 54 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; few fine distinct yellowish brown mottles mainly surrounding iron-manganese and calcium carbonate concretions; weak coarse blocky structure; a few slickensides that do not intersect; extremely hard, very firm, sticky and plastic; few patchy clay films; few shotlike iron-manganese concretions; few irregularly shaped calcium carbonate concretions that have pitted surfaces and that are mainly less than 1 centimeter in size; moderately alkaline; noncalcareous in matrix; gradual wavy boundary.

B3g—54 to 65 inches; gray (5Y 5/1) clay, light gray (5Y 6/1) dry; common vertical streaks of dark gray (10YR 4/1) and few fine distinct yellowish brown and strong brown mottles; massive; very hard, firm, sticky and plastic; few shotlike iron-manganese concretions; about 5 to 7 percent calcium carbonate concretions less than 3 centimeters in size that are irregularly shaped and have pitted surfaces; moderately alkaline, noncalcareous in matrix.

The Ap horizon is 3 to 8 inches thick. It is black, very dark gray or very dark grayish brown and is slightly acid through moderately alkaline. The B1g horizon is the same color as the A horizon. It is clay, clay loam, or silty clay loam that is more than 35 percent clay. It is neutral through moderately alkaline. The B2tg horizon is black, very dark gray, dark gray, gray, very dark grayish brown, dark olive gray, dark grayish brown, olive gray, or grayish brown. It has mottles of yellow or brown. It is clay or silty clay, and is mildly alkaline through moderately alkaline. The B3g horizon is gray, light gray, grayish brown, light brownish gray, olive gray, or light olive gray. It is mottled with yellow, brown, or olive in most places. It is clay, clay loam, or silty clay loam.

Bissonnet Series

The Bissonnet series consists of deep, nearly level, loamy soils on forested uplands. The loamy upper layers of these soils tongue into the more clayey lower layers (fig. 8). These soils formed in thick beds of unconsolidated clay and clay loam sediments.

These soils are somewhat poorly drained. During some wet seasons, they have a perched water table and the lower layers are saturated for 1 to 4 months. Surface runoff and permeability are slow and the available water capacity is high.

Most of these soils are in pine and hardwood trees. Woodland grazing is the main use. A few areas have been cleared and are used for improved pasture and cultivated crops.

Representative profile of Bissonnet very fine sandy loam, in timber, from the intersection of Farm Roads 1960 and 2100 in Huffman, 3.4 miles south along Farm Road 2100, 1.72 miles west on Indian Shores Road, and 400 feet south:

A1—0 to 6 inches; dark grayish brown (10YR 4/2) very fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable; few fine roots; common fine pores; common worm casts; very strongly acid; clear wavy boundary.

A21—6 to 24 inches; brown (10YR 5/3) very fine sandy loam, very pale brown (10YR 7/3) dry; few fine faint yellowish brown mottles and strong brown stains; many sand and silt grains are uncoated; weak fine granular structure; slightly hard, friable; few fine roots; few fine pores; few worm casts; very strongly acid; clear wavy boundary.

A22—24 to 28 inches; pale brown (10YR 6/3) very fine sandy loam, very pale brown (10YR 7/3) dry; few fine faint yellowish brown mottles; many sand and silt grains are uncoated; weak fine granular structure; slightly hard, friable; few fine roots; few fine pores; few worm casts; very strongly acid; clear smooth boundary.

B&A—28 to 32 inches; light brownish gray (10YR 6/2) sandy clay loam, light gray (10YR 7/2) dry; common fine distinct mottles of yellowish brown, strong brown, and red; 15 to 30 percent light gray (10YR 7/2) very fine sandy loam surrounding isolated bodies of more clayey Bt material; weak medium subangular blocky structure; hard, friable; few fine roots; few fine pores, some lined with clay; reddish stains in old root channels; few clay films on surfaces of some peds; few black concretions; many uncoated sand grains; very strongly acid; clear irregular boundary.

B21tg—32 to 42 inches; gray (10YR 6/1) clay loam, light gray (10YR 7/1) dry; common medium prominent red (2.5YR 4/6) mottles and common fine distinct yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; few fine roots; few fine pores; discontinuous clay films on faces of peds; some ped surfaces covered with uncoated fine sand and silt grains; very strongly acid; gradual boundary.

B22tg—42 to 70 inches; gray (10YR 6/1) clay loam, light gray (10YR 7/1) dry; common medium distinct yellowish brown (10YR 5/6) mottles and few fine prominent red mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; discontinuous clay films on faces of peds; some surfaces of peds covered with uncoated fine sand and silt grains; some organic staining on faces of prisms; mildly alkaline in lower part of horizon; noncalcareous.

The A horizon is 20 to 40 inches thick. It is very strongly acid through medium acid. The A1 horizon is dark gray, dark grayish brown, gray, grayish brown, or brown. The A2 horizon is grayish brown, brown, light brownish gray, pale brown, or light yellowish brown. Some profiles have mottles of strong brown, brownish yellow, or yellowish brown in the A2 horizon. The B&A horizon is light brownish gray, pale brown, brown, yellowish brown, or light yellowish brown. It is sandy clay loam, loam, or silty loam. The B&A horizon has mottles of strong brown, yellowish brown, or red. It is very strongly acid through medium acid. The B2t horizon is gray, light brownish gray, or light gray. Mottles are brownish yellow, yellowish brown, strong brown, or red. The B2t horizon is clay loam, sandy clay loam, or silty clay loam. It is very strongly acid through slightly acid in the upper part. It ranges to mildly alkaline in the lower part in some places.

Boy series

The Boy series consists of deep, acid, nearly level to gently sloping, sandy soils in forest. These soils formed in unconsolidated beds of sand, loamy sand, and loam.

These soils are somewhat poorly drained. During wet periods they are saturated for 2 to 4 months in the layer containing plinthite and the soil just above it. Surface runoff is very slow, and in places it is not a hazard at all. Internal drainage and permeability are rapid above the layer containing plinthite, and permeability is moderately slow in the layer containing plinthite. The available water capacity is low.

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

[Data from Houston, elevation 96 feet. Period of record 1931-70]

Month	Temperature				Precipitation											
						Probability of receiving--								Mean number of days with--		
	Mean daily maximum	Mean monthly maximum	Mean daily minimum	Mean monthly minimum	Mean total	0 or trace	.5 inch or more	1 inch or more	2 inches or more	3 inches or more	4 inches or more	5 inches or more	6 inches or more	.1 inch or more	.5 inch or more	1 inch or more
	F	F	F	F	In	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct			
January---	63.6	78.6	43.6	25.0	3.78	<1	97	92	74	54	35	24	14	5	2	1
February--	65.5	79.8	46.0	30.1	3.44	<1	96	90	70	49	30	19	14	5	2	1
March-----	71.7	84.4	50.8	34.1	2.67	<1	93	80	58	38	25	18	10	4	1	1
April-----	78.0	88.0	59.0	45.5	3.24	<1	96	90	70	50	35	20	14	4	2	1
May-------	85.7	91.9	66.2	55.6	4.32	<1	93	85	73	55	43	33	22	5	3	2
June------	91.1	96.2	72.0	65.0	3.69	<1	93	82	63	45	34	25	16	5	3	2
July------	92.1	98.0	73.8	70.2	4.29	<1	96	90	75	55	40	30	25	5	2	1
August----	92.8	98.7	73.6	68.7	4.27	<1	95	85	70	50	40	30	20	6	3	2
September-	89.1	95.7	69.3	59.2	4.26	<1	95	86	70	55	40	30	25	6	3	1
October---	82.3	91.3	60.4	46.1	3.77	3	85	85	55	40	30	20	11	5	2	1
November--	71.1	84.9	50.5	34.1	3.86	<1	94	83	65	50	33	23	20	5	2	1
December--	64.5	79.8	45.9	28.7	4.36	<1	99	95	80	60	50	33	24	6	3	1
Year----	79.0	88.9	59.3	46.9	45.95	--	--	--	--	--	--	--	--	61	28	15

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T
	In	In/hr	In/in	pH					
Bernard:									
Bd	0-6	0.06-0.2	0.15-0.20	6.1-7.3	Moderate	High	Low	0.32	5
	6-34	<0.06	0.12-0.18	6.1-7.8	High	High	Low	0.32	
	34-65	<0.06	0.15-0.20	6.6-8.4	High	High	Low	0.32	
[1]Be:									
Bernard part	0-6	0.06-0.2	0.15-0.20	6.1-7.3	Moderate	High	Low	0.32	5
	6-34	<0.06	0.12-0.18	6.1-7.8	High	High	Low	0.32	
	34-65	<0.06	0.15-0.20	6.6-8.4	High	High	Low	0.32	
Edna part	0-10	0.6-2.0	0.10-0.15	5.6-7.3	Low	High	Low	0.43	5
	10-41	<0.06	0.15-0.20	5.6-7.3	High	High	Low	0.37	
	41-72	<0.06	0.15-0.20	6.6-8.4	High	High	Low	0.37	
[1]Bg:									
Bernard part	0-6	0.06-0.2	0.15-0.20	6.1-7.3	Moderate	High	Low	0.32	5
	6-34	<0.06	0.12-0.18	6.1-7.8	High	High	Low	0.32	
	34-65	<0.06	0.15-0.20	6.6-8.4	High	High	Low	0.32	5
Urban land part.									
Bissonnet:									
Bn	0-28	0.6-2.0	0.14-0.18	4.5-6.0	Low	Low	Moderate	0.43	5
	28-32	0.2-0.6	0.15-0.19	4.5-6.0	Low	Moderate	Moderate	0.43	
	32-70	0.06-0.2	0.16-0.22	4.5-7.8	Moderate	Moderate	Moderate	0.43	
Boy:									
Bo	0-56	6.0-20	0.05-0.10	4.5-6.5	Low	Low	High	0.17	5
	56-75	0.2-0.6	0.10-0.15	4.5-6.0	Low	Low	High	0.24	
Clodine:									
Cd	0-12	0.6-2.0	0.15-0.20	6.1-7.8	Low	High	Low	0.32	5
	12-29	0.6-2.0	0.15-0.20	6.1-8.4	Moderate	High	Low	0.32	
	29-72	0.6-2.0	0.12-0.20	6.6-8.4	Moderate	High	Low	0.32	
[1]Ce:									
Clodine part	0-12	0.6-2.0	0.15-0.20	6.1-7.8	Low	High	Low	0.32	5
	12-29	0.6-2.0	0.15-0.20	6.1-8.4	Moderate	High	Low	0.32	
	29-72	0.6-2.0	0.12-0.20	6.6-8.4	Moderate	High	Low	0.32	
Urban land part.									
Edna:									
Ed	0-5	0.6-2.0	0.10-0.15	5.6-7.3	Low	High	Low	0.43	5
	5-41	<0.06	0.15-0.20	5.6-7.3	High	High	Low	0.37	
	41-72	<0.06	0.15-0.20	6.6-8.4	High	High	Low	0.37	
Gessner:									
Ge, [1]Gs	0-16	0.6-2.0	0.10-0.15	6.1-7.8	Low	High	Low	0.43	5
	16-80	0.6-2.0	0.15-0.20	6.6-8.4	Low	High	Low	0.43	
[1]Gu:									
Gessner part	0-16	0.6-2.0	0.10-0.15	6.1-7.8	Low	High	Low	0.43	5
	16-80	0.6-2.0	0.15-0.20	6.6-8.4	Low	High	Low	0.43	
Urban land part.									
Harris:									
Ha	0-20	0.06-0.2	0.02-0.20	6.6-9.0	High	High	High	0.20	5
	20-45	<0.06	0.01-0.10	6.6-9.0	High	High	High	0.32	
	45-64	<0.06	0.01-0.10	6.6-9.0	High	High	High	0.32	
Hatliff:									
Hf	0-10	2.0-6.0	0.11-0.15	5.1-7.3	Low	Low	Moderate	0.24	5
	10-80	2.0-6.0	0.05-0.11	5.1-7.3	Low	Low	Moderate	0.24	
Hockley:									
HoA, HoB	0-23	2.0-6.0	0.10-0.15	5.1-6.5	Low	Low	Low	0.24	5
	23-50	0.6-2.0	0.12-0.17	5.1-6.5	Moderate	Moderate	Low	0.32	
	50-80	0.2-0.6	0.10-0.15	5.1-6.5	Moderate	Moderate	Low	0.28	

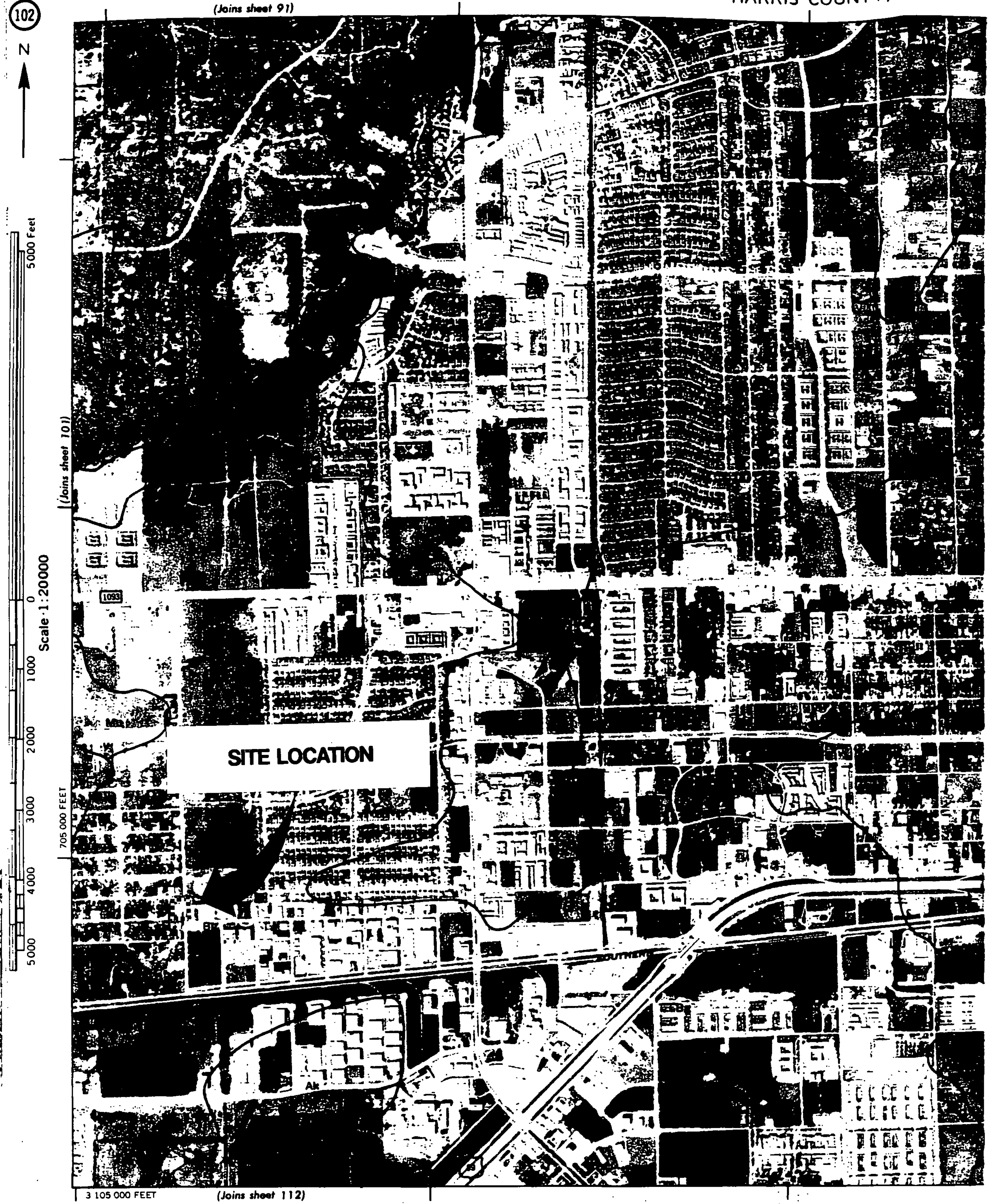
See footnotes at end of table.

TABLE 18.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. The symbol < means less than; > means greater than]

Soil name and map symbol	Hydro-logic group	Flooding			High water table		
		Frequency	Duration	Months	Depth	Kind	Months
					Ft		
Addicks:							
Ad	D	None	---	---	1.0-2.5	Apparent	Jan-Feb
[1]Ak:							
Addicks part	D	None	---	---	1.0-2.5	Apparent	Jan-Feb
Urban land part.							
Aldine:							
Am	D	None	---	---	1.5-2.5	Perched	Nov-May
[1]An:							
Aldine part	D	None	---	---	1.5-2.5	Perched	Nov-May
Urban land part.							
Aris:							
Ap	D	None	---	---	0-2.0	Perched	Nov-Mar
[1]Ar:							
Aris part	D	None	---	---	0-2.0	Perched	Nov-Mar
Gessner part	B/D	None	---	---	0-2.0	Apparent	Nov-May
[1]As:							
Aris part	D	None	---	---	0-2.0	Perched	Nov-Mar
Urban land part.							
Atasco:							
AtB	C	None	---	---	1.5-2.5	Perched	Nov-Feb
Beaumont:							
Ba	D	Rare	---	---	0-2.0	Apparent	Nov-Mar
[1]Bc:							
Beaumont part	D	Rare	---	---	0-2.0	Apparent	Nov-Mar
Urban land part.							
Bernard:							
Bd	D	None	---	---	0-3.0	Apparent	Dec-Feb
[1]Be:							
Bernard part	D	None	---	---	0-3.0	Apparent	Dec-Feb
Edna part	D	None	---	---	0-1.5	Perched	Dec-Mar
[1]Bg:							
Bernard part	D	None	---	---	0-3.0	Apparent	Dec-Feb
Urban land part.							
Bissonnet:							
Bn	D	None	---	---	2.0-3.5	Perched	Nov-Feb
Boy:							
Bo	B	None	---	---	3.5-5.5	Perched	Nov-Feb
Clodine:							
Cd	D	None	---	---	0-2.5	Apparent	Dec-Mar
[1]Ce:							
Clodine part	D	None	---	---	0-2.5	Apparent	Dec-Mar
Urban land part.							

See footnotes at end of table.


102
N
(Joins sheet 91)
(Joins sheet 101)
(Joins sheet 112)
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
705 000 FEET
3 105 000 FEET
1093
SITE LOCATION

PA-SCORE

REFERENCE 6

RECORD OF COMMUNICATION

TYPE: Outgoing Phone Call	**DATE:** 5-11-92		**TIME:** 3:05 p.m

TO: Ms.Katahlie
City of Houston
Water Engineering Department
(713)-247-1000

FROM: Kevin Jaynes
Site Manager
ICF Technology Incorporated
214-979-3900

SUBJECT: West Houston Ground Water Wells

SUMMARY OF COMMUNICATION:

Ms. Katahlie explained that the Houston system is a blended system with 216 wells and surface water. The system serves those within the city limits, total population of the City of Houston. They do not figure the number of connections per well since each well is pumped to a water tank and then sent to distribution as needed.

PA-SCORE

REFERENCE 7

RECORD OF COMMUNICATION

TYPE: Incoming Phone Call **DATE:** 5-8-92 **TIME:** 2:45 p.m.

TO: Kevin Jaynes
Site Manager
ICF Technology Incorporated
214-979-3900

FROM: Charles Leideigh
Harris County
Engineering Division
713-620-6860

SUBJECT: West Houston Water

SUMMARY OF COMMUNICATION:

Mr. Leideigh returned my call. Mr. Leideigh stated that west Houston, within the city limits and outside of 610 Loop, was on 100% well water; inside the Loop is on surface water from Lake Houston.

H.C.MUP#57 was not listed. The well #226 on map at Harwin Drive and Willcrest is actually a City of Houston well.

The well has been tested for Arsenic because Crystal Chemical, a NPL site is located nearby. Other private wells nearby have been closed and used as monitor wells for Crystal Chemical. This system for City of Houston is technically blended but is not actually blended. The system is set up as a blended system but the surface water never reaches the areas outside of the 610 Loop.

Mr. Leideigh suggested I call the City of Houston Water Quality Branch at 713-880-2444.

Also, Memorial Villages has their own separate water system serving over 10,000 people. Their number is 713-465-8318. Mike Montgomery is the manager.

PA-SCORE

REFERENCE 8

RECORD OF COMMUNICATION

TYPE: Phone Call **DATE:** 11/30/89 **TIME:** 2:20 p.m.

TO: Kay Hodges
Chamber of Commerce
Houston, TX
(713)-651-1313

FROM: Luis Vega
FIT Biologist
ICF Technology, Inc.
Dallas, TX
(214)-744-1641

SUBJECT:

Population Density of the Houston/Harris County, TX Area

SUMMARY OF COMMUNICATION:

In a phone call with Kay Hodges of the Houston Chamber of Commerce, the following information was given:

> The population of Houston, Harris County, TX in the consolidated metropolitan statistical area is 3,580,000. This includes the surrounding counties and incorporated limits covering an area of 7,422.38 square miles.
>
> The population of Harris County only is 2,740,900.
>
> The population of Houston, Harris County, TX in the principle metropolitan statistical area is 3,182,900, and covers an area of 5,435.48 square miles. The number of households in Houston is 1,196,700, which gives an average population per household of 2.66.

NOTE: The above information is based on the 1980 Census information.

CONCLUSIONS:

Using the data for the principle metropolitan statistical area, the population density for the Houston, Harris County, TX area is calculated as 586 persons per square mile.

> 3,182,900 divided by 5,435.48 square miles = 585.85 persons/square mile (586 persons).

PA-SCORE

REFERENCE 9

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN HARRIS AND GALVESTON COUNTIES, TEXAS, 1980-84

U.S. GEOLOGICAL SURVEY
Open-File Report 87-378

Prepared in cooperation with the
CITY OF HOUSTON and the
HARRIS-GALVESTON COASTAL SUBSIDENCE DISTRICT

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN HARRIS AND GALVESTON COUNTIES, TEXAS, 1980-84

By James F. Williams, III, L.S. Coplin, C.E. Ranzau, Jr.,
W.B. Lind, C.W. Bonnet, and Glenn L. Locke

U.S. GEOLOGICAL SURVEY
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1987

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METRIC CONVERSIONS

Factors for converting inch-pound units to metric (International System) units are given in the following table:

Multiply inch-pound unit	By	To obtain metric units
foot (ft)	0.3048	meter
gallon per minute (gal/min)	0.06309	liter per second
inch	25.4	millimeter

National Geodetic Vertical Datum of 1929 (NGVD of 1929): A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "mean sea level."

Table 1.--Records of Wells in Harris County

Water Levels and Drawdown : Reported water levels given in feet; measured water levels given in feet.
Use of Water : H, domestic; I, irrigation; N, industrial; P, public supply; R, recreational; T, institution; U, unused.
Water-Bearing Unit : CHCT, Chicot aquifer; EVGL, Evangeline aquifer; JSPR, Jasper aquifer.
Type of Data Available : C, caliper log; D, drillers' log (see table 2); E, electric log; I, induction log; J, gamma-ray; L, lateral log; M, microlateral log; N, neutron log; Q, chemical analysis (see table 4); S, sonic log; W, water-level measurements (see table 3).

Well	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Screen: Length (feet)	Screen: Depth interval (feet)	Water-bearing unit	Altitude of land surface (feet)	Water level: Below land surface datum (feet)	Water level: Date of measurement	Use of water	Discharge (gallons per minute)	Drawdown (feet)	Type of data available
LJ-60-52-808	Champion Land	Bussell and Son, Inc.	1980	360	6,4	30	330 - 360	EVGL	176	78.00	04/23/1980	P	--	--	D
LJ-60-52-901	Northwest Harris County M.U.D. 19, Well No. 2	Lanford Drilling Co., Inc.	1982	880	16,10	340	530 - 870	EVGL	160	191.48	03/22/1983	P	800	162.00	D,E,Q
LJ-60-57-908	Lindsey, C.M., Well No. 3	Layne-Texas Co.	1982	910	18,12	350	200 - 900	EVGL	234	147.00	03/06/1982	I	3,046	80.00	D,I
LJ-60-58-508	Boy's Country	Pomykal Drilling Co.	1979	355	6	36	319 - 355	EVGL	210	137.00	06/ /1979	H	600	--	D
LJ-60-58-603	Girl's Country	Pomykal Drilling Co.	1980	328	6,4	44	284 - 328	EVGL	225	117.00	11/03/1980	H	100	--	D
LJ-60-59-323	City of Tomball	Alsay-Pippin Corp.	1979	451	16,10	142	222 - 444	CHCT, EVGL	195	75.20	10/21/1980	P	503	25.00	D,E
LJ-60-59-901	Lance, Steve	Bufkin Water Well	1983	265	5,2	20	245 - 265	CHCT	163	90.00	05/05/1983	P	100	--	D
LJ-60-60-307	Five Oaks Subdivision, Well No. 1	O'Day Drilling Co., Inc.	1981	386	6,4	30	356 - 386	CHCT	145	113.00	11/02/1981	P	250	--	D
LJ-60-60-308	Five Oaks Subdivision, Well No. 2	O'Day Drilling Co., Inc.	1981	385	6,4	30	355 - 385	CHCT	145	113.00	11/10/1981	P	300	--	D
LJ-60-60-504	Glenloch Farms, Well No. 3	Raymond Water Wells	1979	363	6,4	37	296 - 363	CHCT	146	115.00	10/20/1979	I	--	--	D
LJ-60-60-603	Klein I.S.D.	Bussell and Son, Inc.	1980	502	8,6	60	372 - 502	CHCT, EVGL	141	146.00	05/08/1980	P	480	63.00	D
LJ-60-60-809	Charterwood M.U.D., Well No. 2	Layne-Texas Co.	1980	680	20,14	137	427 - 677	CHCT, EVGL	135	200.00	07/28/1980	P	1,012	55.00	E,Q
LJ-60-60-810	Louetta North P.U.D., Well No. 1	Layne-Western Co., Inc.	1984	1,210	20,14,12	190	623 -1,200	EVGL	138	309.00	07/ /1984	P	1,529	95.00	D
LJ-60-60-914	Bilma P.U.D., Well No. 1	Layne-Texas Co.	1981	1,115	16,10	210	690 -1,100	EVGL	120	252.00	06/24/1981	P	1,022	55.00	D,E,Q
LJ-60-60-915	Harris County M.U.D. 24, Well No. 2	Layne-Texas Co.	1982	1,105	16,10	170	830 -1,090	EVGL	135	266.00	12/09/1982	P	1,040	69.00	D,E,L,Q
LJ-60-61-409	Bridgestone M.U.D., Well No. 2	Water Resources of Texas	1980	632	20,14,12	200	280 - 622	CHCT, EVGL	140	169.00	08/04/1980	P	1,000	55.00	D,Q
LJ-60-61-719	Harris County M.U.D. 211, Well No. 1	Lanford Drilling Co., Inc.	1982	814	16,12	374	440 - 814	CHCT, EVGL	112	228.00	10/12/1982	P	1,212	113.00	D,E,Q

Table 1.--Records of Wells in Harris County--Continued

Well	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Screen: Length (feet)	Screen: Depth interval (feet)	Water-bearing unit	Altitude of land surface (feet)	Water level: Below land surface datum (feet)	Water level: Date of measurement	Use of water	Discharge (gallons per minute)	Drawdown (feet)	Type of data available
LJ-65-11-806	Longhorn Town U.D., Well No. 1	Layne-Texas Co.	1983	1,395	16,10	210	860 -1,380	EVGL	101	270.00	05/07/1983	P	1,001	54.00	D,I,Q
LJ-65-11-916	Harris County M.U.D. 21, Well No. 1	Layne-Texas Co.	1981	1,170	18,12	255	668 -1,150	EVGL	96	340.00	10/12/1981	P	1,500	83.00	D,Q,W
LJ-65-11-917	Memorial West U.D., Well No. 2	Alsay-Texas Corp.	1983	1,288	24,18	--	636 - 998	EVGL	98	282.30	05/26/1983	P	2,000	107.70	D,I,Q
LJ-65-11-918	Harris County M.U.D. 175, Phase One	Alsay-Texas Corp.	1983	1,316	24,18,14	422	550 -1,152	EVGL	91	280.00	10/17/1983	P	2,000	82.94	D,I,Q
LJ-65-12-109	Horsepen Bayou M.U.D., Well No. 1	Alsay-Pippin Corp.	1980	1,146	16,10	280	696 -1,136	EVGL	113	271.00	03/11/1980	P	1,000	62.00	D,E
LJ-65-12-519	City of Houston, Katy-Addicks, Well No. 10	Layne-Texas Co.	1979	1,200	24,18,14	290	634 -1,184	EVGL	102	343.00	01/04/1980	P	2,539	86.00	D,E,Q,W
LJ-65-12-520	City of Houston, Katy-Addicks, Well No. 9	Layne-Texas Co.	1980	1,530	24,18,14	345	833 -1,512	EVGL	103	371.70	06/11/1980	P	2,513	119.00	D,E,Q,W
LJ-65-12-626	Spring Branch I.S.D.	--	--	560	6,4	--	--	CHCT	80	239.00	10/14/1963	P	--	--	--
LJ-65-12-730	City of Houston, Katy-Addicks, Well No. 11	Alsay-Texas Corp.	1983	1,712	24,18,14	575	685 -1,692	EVGL	85	358.45	01/17/1984	P	2,500	103.00	D,I,Q,W
LJ-65-12-731	Harris County M.U.D. 223, Well No. 1	Layne-Texas Co.	1983	1,190	24,18	328	517 -1,170	CHCT, EVGL	87	295.00	11/07/1983	P	1,918	91.00	D,Q
LJ-65-12-817	City of Houston, District 71, Well No. 3	Layne-Western Co., Inc.	1979	967	18,12	224	597 - 957	EVGL	80	260.00	05/01/1979	P	1,557	130.00	D,E,W
LJ-65-12-939	Memorial Villages Water Authority, Well No. 5 3 MI	Layne-Western Co., Inc.	1981	1,620	20,12	301	810 -1,610	EVGL	74	420.00	04/ /1981	P	2,089	100.00	D
LJ-65-13-322	City of Houston, Heights, Well No. 15-A	Layne-Texas Co.	1981	1,675	24,18,14	468	682 -1,665	EVGL	78	395.00	05/26/1981	P	2,513	73.00	D,E,Q,W
LJ-65-13-626	City of Houston, Heights, Well No. 6	Layne-Western Co., Inc.	1982	1,455	24,18,14	419	665 -1,440	EVGL	68	400.00	06/ /1982	P	2,000	56.00	D,W
LJ-65-13-627	City of Houston, Heights, Well No. 7-A	Layne-Western Co., Inc.	1979	1,465	24,18,14	424	702 -1,454	EVGL	69	360.00	11/30/1981	P	2,100	68.00	--
LJ-65-13-748	Houston Country Club, Well No. 2 3 MI	Layne-Texas Co.	1980	1,197	20,14,10	145	965 -1,185	EVGL	65	385.00	12/09/1980	I	1,200	40.00	D,E,Q
LJ-65-13-749	Memorial Villages Water Authority, Well No. 6 4 MI	Alsay-Texas Corp.	1983	1,526	20,14	380	786 -1,506	EVGL	71	392.40	02/10/1984	P	2,006	53.00	D,I,M,Q
LJ-65-14-732	National Vinegar Company	Hildebrandt Well Service	1968	506	4	20	486 - 506	CHCT	50	200.00	07/20/1968	N	--	--	--

Table 1.--Records of Wells in Harris County--Continued

Well	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Screen: Length (feet)	Screen: Depth interval (feet)	Water-bearing unit	Altitude of land surface (feet)	Water level: Below land surface datum (feet)	Water level: Date of measurement	Use of water	Discharge (gallons per minute)	Drawdown (feet)	Type of data available
LJ-65-20-225	City of Houston, District 71, Well No. 1	Layne-Western Co., Inc.	1972	1,356	18,12	200	1,054 -1,350	EVGL	80	364.00	08/01/1978	P	1,500	80.00	D,E,Q,W
LJ-65-20-226	Harris County M.U.D. 61, Well No. 2 #4HI	Layne-Western Co., Inc.	1979	1,610	20,12	287	1,144 -1,600	EVGL	80	--	--	P	--	--	D,Q
LJ-65-20-323	Cornelius Nurseries, Inc. ZHI	Raymond Water Wells	1983	295	5,2	30	250 - 290	CHCT	70	180.00	06/16/1983	C	32	15.00	D
LJ-65-20-415	Bissonnet M.U.D., Water Plant 2, Well No. 1	Layne-Texas Co.	1983	1,525	20,14	325	1,059 -1,510	EVGL	89	345.00	08/30/1983	P	2,611	84.00	D,I,Q
LJ-65-20-625	Memorial Hospital South-west, Well No. 1 3HI	Layne-Western Co., Inc.	1982	1,240	16,10	--	735 -1,226	EVGL	72	348.00	02/25/1982	P	1,016	31.00	D
LJ-65-20-626	City of Houston, Sharp-stown, Well No. 3-A ZHI	Alsay-Texas Corp.	1981	1,550	24,18,14	324	920 -1,530	EVGL	70	393.31	09/25/1981	P	2,000	79.00	D,E,Q
LJ-65-20-912	Southwest Harris County M.U.D. 1, Well No. 1	Layne-Texas Co.	1980	772	10,6	115	550 - 760	CHCT, EVGL	65	262.00	06/02/1980	P	542	38.00	D,E,Q
LJ-65-21-147	Texaco, Inc.	Raymond Water Wells	1981	475	6,4	30	438 - 468	CHCT	60	250.00	03/05/1981	N	96	2.00	D
LJ-65-21-148	City of Houston, South-west, Well No. 3-A ZHI	Layne-Texas Co.	1981	1,505	24,18,14	425	699 -1,490	EVGL	64	392.00	05/05/1981	P	2,513	100.00	D,E,Q
LJ-65-21-149	City of Houston, South-west, Well No. 4-A ZHI	Alsay-Texas Corp.	1982	1,518	24,18,14	501	690 -1,498	EVGL	69	416.00	06/06/1982	P	2,000	32.00	D,E,Q,W
LJ-65-21-150	City of Houston, South-west, Well No. 3-SB ZHI	Layne-Texas Co.	1982	646	24,18	238	330 - 631	CHCT	64	260.00	04/28/1982	P	1,560	141.00	D,E,Q,W
LJ-65-21-226	Harris-Galveston Coastal Subsidence District, Southwest, Well No. 1	Layne-Texas Co.	1980	2,358	5	20	2,316 -2,336	EVGL	64	302.95	03/12/1980	U	--	--	E,I,J,N,Q,S,W
LJ-65-21-227	Harris-Galveston Coastal Subsidence District, Southwest, Well No. 3	Layne-Western Co., Inc.	1980	1,433	4,2	10	1,418 -1,428	EVGL	64	411.15	04/05/1980	U	--	--	D,Q,W
LJ-65-21-228	Harris-Galveston Coastal Subsidence District, Southwest, Well No. 5	Layne-Western Co., Inc.	1980	253	4,2	10	238 - 248	CHCT	64	177.67	04/09/1980	U	--	--	D,Q,W
LJ-65-21-229	Harris-Galveston Coastal Subsidence District, Southwest, Well No. 4	Layne-Western Co., Inc.	1980	627	4,2	10	612 - 622	CHCT	64	314.21	05/06/1980	U	--	--	D,Q,W
LJ-65-21-230	Harris-Galveston Coastal Subsidence District, Southwest, Well No. 2	Layne-Western Co., Inc.	1980	1,943	4,2	10	1,928 -1,938	EVGL	64	383.72	04/15/1980	U	--	--	D,Q,W
LJ-65-21-231	City of West University Place, Well No. 7	Layne-Western Co., Inc.	1980	1,360	20,12	264	780 -1,295	EVGL	58	380.00	04/ /1980	P	1,560	47	D

Table 2.--Drillers' logs of wells in Harris County--Continued

	Thickness (feet)	Depth (feet)
Well LJ-65-12-817		
Owner: City of Houston, Water Control and Improvement District 71		
Driller: Layne-Western Co., Inc.		
Clay, sandy	23	23
Sand	19	42
Clay	10	52
Sand	9	61
Clay	12	73
Sand	43	116
Clay	24	140
Sand	6	146
Clay	9	155
Sand	3	158
Clay	75	233
Sand	30	263
Clay	40	303
Sand	20	323
Clay	47	370
Sand and rock	5	375
Clay	82	457
Sand and rock	12	469
Clay	21	490
Sand	7	497
Clay	14	511
Sand and rock	2	513
Clay	18	531
Sand and rock	5	536
Clay	9	545
Sand and rock	15	560
Clay	85	645
Sand	5	650
Clay	64	714
Sand and rock	5	719
Well LJ-65-12-817--Continued		
Clay	11	730
Sand and rock	12	742
Clay	28	770
Sand and rock	17	787
Clay	23	810
Sand and hard rock	76	886
Clay	85	971
Well LJ-65-12-939 BMI		
Owner: Memorial Villages Water Authority, Well No. 5		
Driller: Layne-Western Co., Inc.		
Unrecorded	40	40
Clay	9	49
Clay, sandy	13	62
Clay	18	80
Sand	15	95
Clay	31	126
Sand	10	136
Clay, sandy	21	157
Clay and sandy streaks	15	172
Clay	8	180
Clay, sandy	5	185
Clay and sandy streaks	23	208
Sand and clay streaks	62	270
Clay, hard and shale	17	287
Sand	5	292
Clay	20	312
Sand	17	329
Shale	20	349
Sand	9	358
Clay and sand streaks	14	372
Sand with clay streaks	39	411
Sand	9	420

Table 2.--Drillers' logs of wells in Harris County--Continued

	Thickness (feet)	Depth (feet)
Well LJ-65-12-939--Continued 3M1		
Clay and sand streaks	10	430
Sand and clay streaks	18	448
Clay	10	458
Sand and clay streaks	8	466
Sand	22	488
Clay	7	495
Sand	30	525
Clay	40	565
Sand	31	596
Clay	9	605
Sand	15	620
Clay	45	665
Sand	20	685
Clay	20	705
Sand and clay streaks	25	730
Clay	25	755
Clay and sand streaks	15	770
Sand	19	789
Clay	32	821
Sand	14	835
Clay	65	900
Shale, hard	60	960
Sand	20	980
Clay	9	989
Sand	46	1,035
Clay	5	1,040
Sand	13	1,053
Clay and sand streaks	12	1,065
Clay	6	1,071
Sand and clay	11	1,082
Sand	48	1,130
Clay	10	1,140

	Thickness (feet)	Depth (feet)
Well LJ-65-12-939--Continued 3M1		
Sand and hard streaks	23	1,163
Sand	18	1,181
Clay	9	1,190
Sand and clay streaks	30	1,220
Clay	94	1,314
Limestone	7	1,321
Sand and limestone	42	1,363
Clay	7	1,370
Sand with limestone streaks	30	1,400
Clay	5	1,405
Limestone, hard	85	1,490
Limestone and sand streaks	30	1,520
Sand	12	1,532
Limestone and sand streaks	63	1,595
Sand	14	1,609
Sand and limestone streaks	71	1,680
Clay and sand streaks	40	1,720
Limestone and sand	3	1,723
Sand and clay	11	1,734
Sand	68	1,802
Well LJ-65-13-322 Owner: City of Houston, Heights, Well No. 15A Driller: Layne-Texas Co.		
Unrecorded	28	28
Sand	7	35
Clay	48	83
Sand	49	132
Clay	7	139
Sand	71	210
Clay	38	248
Sand	11	259
Clay	26	285
Sand and shale	32	317

Table 2.--Drillers' logs of wells in Harris County--Continued

	Thickness (feet)	Depth (feet)
Well LJ-65-13-627--Continued		
Shale and hard sand streaks	94	228
Sand, red and shale	20	248
Sand and shale streaks	12	260
Shale and sand	48	308
Sand and gravel	7	315
Shale, hard and limestone	7	322
Sand and gravel	17	339
Shale and limestone	7	346
Sand	16	362
Shale, sandy	13	375
Sand	10	385
Shale and limestone	15	400
Sand and shale streaks	30	430
Shale and limestone	24	454
Shale, sandy	26	480
Shale and sand streaks	50	530
Shale	25	555
Clay, sandy	12	567
Sand and clay streaks	5	572
Sand, shale streaks and clay	58	630
Sand and shale streaks	19	649
Shale	3	652
Shale, sandy	6	658
Shale and sand streaks	3	661
Sand	4	665
Sand, shale and gravel	85	750
Sand and shale	29	779
Shale, sandy and limestone	32	811
Sand and shale streaks	31	842
Shale	16	858
Clay and sand	20	878
Limestone	6	884

	Thickness (feet)	Depth (feet)
Well LJ-65-13-627--Continued		
Clay, sandy	15	899
Shale, hard and limestone	16	915
Clay, sandy	23	938
Clay, sticky	65	1,003
Sand and limestone	15	1,018
Clay, limestone and shale	62	1,080
Limestone streaks and shale	130	1,210
Limestone	14	1,224
Sand and limestone streaks	76	1,300
Shale streaks and sandy clay	40	1,340
Sand	5	1,345
Clay	3	1,348
Sand	7	1,355
Limestone	3	1,358
Shale, sandy and limestone	37	1,395
Sand	10	1,405
Shale, sandy and limestone	5	1,410
Sand and sandy shale	8	1,418
Sand, shale and limestone	32	1,450
Shale and sand streaks	68	1,518
Sand	32	1,550
Well LJ-65-13-748 341 Owner: Houston Country Club, Well No. 2 Driller: Layne-Texas Co.		
Topsoil	6	6
Clay	25	31
Clay, sandy	28	59
Clay	32	91
Sand	8	99
Clay	47	146
Sand	26	172
Sand and lime streaks	48	220
Lime	5	225

Table 2.--Drillers' logs of wells in Harris County--Continued

Well LJ-65-13-748--Continued 3H1

	Thickness (feet)	Depth (feet)
Sand	13	238
Lime, sticky	5	243
Sand and lime streaks	50	293
Shale, blue and red	10	303
Sand with lime and shale streaks	36	339
Lime with red shale and sand	14	353
Sand	5	358
Lime with red shale and sand	15	373
Sand and red shale	45	418
Shale, red	6	424
Sand and shale streaks	33	457
Sand and lime streaks	186	643
Sand and red shale with lime streaks	81	724
Sand and lime streaks	20	744
Lime and sand streaks	38	782
Sand	13	795
Shale, gray and blue with sand streaks	31	826
Shale, hard, red and blue	24	850
Shale, hard	63	913
Shale, sticky, brown and gray	39	952
Shale, sandy, gray and blue	37	989
Sand with lime and gray shale	33	1,022
Shale, gray and sand streaks	59	1,081
Sand and shale	162	1,243
Shale	19	1,262
Shale and sand streaks	33	1,295
Shale	61	1,356
Shale and sand	114	1,470
Sand and shale streaks	21	1,491
Shale	13	1,504

Well LJ-65-13-749 4H1
Owner: Memorial Villages Water Authority, Well No. 6
Driller: Alsay-Texas Corp.

	Thickness (feet)	Depth (feet)
Topsoil	2	2
Clay, red	13	15
Sand, white	49	64
Clay, red	18	82
Sand, white and clay	36	118
Clay, gray	7	125
Sand, white and black	35	160
Sand, white and clay	63	223
Sand and gray clay	32	255
Sand, white and black	45	300
Clay, gray	14	314
Sand and gravel	71	385
Clay, white	17	402
Sand and white clay traces	111	513
Clay and sand stringers	62	575
Sand, tan and white	50	625
Sand and clay stringers	105	730
Shale, gray	49	779
Sand, tan	71	850
Clay, tan-to-white	90	940
Sand, tan	30	970
Clay, white	24	994
Sand and shale stringers	200	1,194
Shale, gray and brown	181	1,375
Sand, tan	20	1,395
Shale, gray and brown	25	1,420
Sand, tan-to-gray	60	1,480
Shale and sand stringers	120	1,600

Table 2.--Drillers' logs of wells in Harris County--Continued

	Thickness (feet)	Depth (feet)
Well LJ-65-20-225--Continued		
Sand	88	1,265
Clay	50	1,315
Sand and rock	35	1,350
Clay	40	1,390
Sand	21	1,411
Clay	44	1,455
Sand	10	1,465
Shale	12	1,477
Sand and rock	7	1,484
Well LJ-65-20-226 Owner: Harris County Municipal Utility District 51, Well No. 2 Driller: Layne-Western Co., Inc.		
Clay	6	6
Sand and clay	59	65
Clay	105	170
Sand	165	335
Clay	25	360
Sand	62	422
Sand and clay strips	10	432
Sand	8	440
Clay	17	457
Sand	363	820
Shale	80	900
Sand and shale	100	1,000
Sand	20	1,020
Shale	30	1,050
Sand and shale strips	100	1,150
Clay	170	1,320
Sand and rock breaks	100	1,420
Clay	33	1,453
Shale and clay	34	1,487
Sand	6	1,493
Well LJ-65-20-226--Continued		
Shale	33	1,526
Sand and shale	45	1,571
Sand and rock	5	1,576
Shale and clay	4	1,580
Shale and sand	52	1,632
Sand and rock	26	1,658
Sand and shale	38	1,696
Shale and clay	54	1,750
Sand and clay	35	1,785
Clay	18	1,803
Well LJ-65-20-323 Owner: Cornelius Nurseries, Inc. Driller: Raymond Water Wells		
Clay, red and gray	120	120
Sand	95	215
Clay	5	220
Clay, red and gray	20	240
Sand	30	270
Clay	7	277
Sand	13	290
Clay	7	297
Well LJ-65-20-415 Owner: Bissonnet Municipal Utility District, Plant 2, Well No. 1 Driller: Layne-Texas Co.		
Topsoil	2	2
Clay	6	8
Sand	30	38
Clay and sand streaks	152	190
Shale	105	295
Sand and shale streaks	78	373
Shale, red and gray with sand streaks	72	445
Sand and shale streaks	35	480
Shale	15	495

Table 2.--Drillers' logs of wells in Harris County--Continued

	Thickness (feet)	Depth (feet)
Well LJ-65-20-625--Continued		
Sand	23	471
Clay	50	521
Sand	12	533
Shale and sand streaks	28	561
Sand and clay streaks	48	609
Clay	22	631
Sand	7	638
Shale	3	641
Clay	6	647
Sand	3	650
Clay	10	660
Sand	11	671
Clay	27	698
Sand	28	726
Shale	32	758
Sand	45	803
Shale	30	833
Sand	12	845
Shale	40	885
Sand	10	895
Shale	16	911
Sand	58	969
Shale	181	1,150
Shale, sandy	45	1,195
Sand	35	1,230
Shale	55	1,285
Well LJ-65-20-626 Owner: City of Houston, Sharpstown, Well No. 3A Driller: Alsay-Texas Corp.		
Topsoil	3	3
Sand	35	38
Clay, light blue	20	58
Clay, red	18	76

	Thickness (feet)	Depth (feet)
Well LJ-65-20-626--Continued		
Sand	7	83
Clay, gray	10	93
Clay, red	30	123
Clay, gray	78	201
Sand	10	211
Clay, gray	17	228
Sand	30	258
Clay, gray	20	278
Sand	15	293
Clay, gray, sandy	20	313
Sand	45	358
Clay, gray, sandy	23	381
Clay, gray	17	398
Sand	30	428
Clay, gray	45	473
Sand	20	493
Clay, gray, sandy	10	503
Sandstone, hard	3	506
Shale, gray	10	516
Sand	45	561
Shale, gray	53	614
Sand	39	653
Shale	38	691
Sand	12	703
Shale, gray	30	733
Sand	30	763
Shale	75	838
Sand	10	848
Shale, gray	63	911
Sand	38	949
Shale, gray	19	968
Sand	24	992

Table 2.--Drillers' logs of wells in Harris County--Continued

Well LJ-65-20-626--Continued

	Thickness (feet)	Depth (feet)
Shale, gray	30	1,022
Sand	35	1,057
Shale, gray	68	1,125
Sandstone, hard	1	1,126
Sand	10	1,136
Shale, blue, sandy	16	1,152
Sand	8	1,160
Shale, gray	12	1,172
Sand	47	1,219
Shale, gray	28	1,247
Shale, gray, sandy	16	1,263
Sand	14	1,277
Shale, red, hard	84	1,361
Sand	43	1,404
Sand and shale streaks	54	1,458
Sand	66	1,524
Shale, gray	80	1,604
Sand, hard	16	1,620
Shale, gray	18	1,638

Well LJ-65-20-912
Owner: Southwest Harris County Municipal Utility District 1, Well No. 1
Driller: Layne-Texas Co.

	Thickness (feet)	Depth (feet)
Clay and sand streaks	80	80
Sand	21	101
Clay, sandy and sand streaks	45	146
Clay, hard, sticky and sandy clay	59	205
Sand	8	213
Clay, sandy and sand streaks	23	236
Sand, broken	14	250
Sand and sandy clay	88	338
Shale, sandy	7	345
Shale	45	390
Sand	8	398

Well LJ-65-20-912--Continued

	Thickness (feet)	Depth (feet)
Shale, sandy	37	435
Sand	27	462
Shale	9	471
Sand	23	494
Shale	12	506
Sand	23	529
Shale, sandy	31	560
Sand and gravel	45	605
Shale, sandy and sand streaks	65	670
Sand, broken	44	714
Shale, sandy	16	730
Sand and lime streaks	20	750
Shale, sandy	10	760

Well LJ-65-21-147
Owner: Texaco, Inc.
Driller: Raymond Water Wells

	Thickness (feet)	Depth (feet)
Clay	50	50
Sand	10	60
Clay	20	80
Sand	34	114
Clay	48	162
Sand	8	170
Sand, red and white	15	185
Sand	35	220
Clay, blue	30	250
Clay, gray	30	280
Shale	20	300
Clay, red and gray	54	354
Sand	16	370
Clay	25	395
Sand	15	410
Rock	1	411
Sand	9	420

Table 2.--Drillers' logs of wells in Harris County--Continued

	Thickness (feet)	Depth (feet)
Well LJ-65-21-147--Continued		
Clay, blue	20	440
Sand	28	468
Clay	7	475

Well LJ-65-21-148
Owner: City of Houston, Southwest, Well No. 3A
Driller: Layne-Texas Co.

	Thickness (feet)	Depth (feet)
Clay, sandy	20	20
Clay	102	122
Clay, sandy	22	144
Clay	22	166
Sand and clay streaks	149	315
Sand	71	386
Sand and gravel	27	413
Clay	24	437
Sand	39	476
Clay	13	489
Sand	14	503
Lime	8	511
Sand	23	534
Lime	4	538
Sand	7	545
Lime	4	549
Sand	32	581
Shale, sandy	84	665
Clay and sand	103	768
Shale, sandy	54	822
Shale	215	1,037
Clay, sandy	82	1,119
Sand, shale and shale streaks	66	1,185
Shale	13	1,198
Sand	41	1,239
Shale and sandy shale	119	1,358
Shale, sandy	32	1,390
Well LJ-65-21-148--Continued		
Shale	23	1,413
Shale, sandy	69	1,482
Clay	74	1,556
Sand and shale streaks	9	1,565
Clay, sandy	105	1,670
Shale	62	1,732
Shale and lime streaks	31	1,763
Shale	56	1,819
Lime	13	1,832
Shale, sandy	58	1,890
Sand and shale streaks	88	1,978
Shale	11	1,989
Sand	88	2,077
Shale and sand streaks	20	2,097
Shale, sandy	94	2,191
Shale	10	2,201

Well LJ-65-21-149
Owner: City of Houston, Southwest, Well No. 4A
Driller: Alsay-Texas Corp.

	Thickness (feet)	Depth (feet)
Unrecorded	240	240
Sand	5	245
Clay	20	265
Sand	25	290
Sand and clay	75	365
Sand and clay	35	400
Sand, gravel and clay	70	470
Clay	51	521
Sand	29	550
Sand and clay	80	630
Clay, yellow	20	650
Sand	26	676
Clay	16	692
Sand	6	698

Table 2.--Drillers' logs of wells in Harris County--Continued

	Thickness (feet)	Depth (feet)
Well LJ-65-21-149--Continued		
Clay	7	705
Clay streaks	44	749
Clay	66	815
Clay and sand	25	840
Clay and sand streaks	20	860
Sand and shale	61	921
Sand and clay	127	1,048
Clay and sand streaks	71	1,119
Sand	44	1,163
Clay	18	1,181
Sand	67	1,248
Clay	30	1,278
Sand	46	1,324
Clay, hard	16	1,340
Clay	28	1,368
Clay and sand streaks	21	1,389
Clay	40	1,429
Sand streaks	69	1,498
Clay	17	1,515
Well LJ-65-21-150[3] Owner: City of Houston, Southwest, Well No. 3SB Driller: Layne-Texas Co.		
Topsoil	1	1
Clay	9	10
Sand	5	15
Clay, sandy clay and caliche streaks	13	28
Clay	14	42
Sand	6	48
Clay	16	64
Sand	3	67
Clay streaks and sandy clay	14	81
Sand and clay streaks	5	86
Clay and sandy clay	19	105

	Thickness (feet)	Depth (feet)
Well LJ-65-21-150--Continued		
Sand and clay	4	109
Clay and caliche streaks	8	117
Clay, red and sand streaks	16	133
Clay, gray and caliche	10	143
Sand and clay streaks	5	148
Shale	15	163
Sand and shale streaks	5	168
Shale	7	175
Clay, sandy and sand	3	178
Gravel and sand	21	199
Clay	5	204
Shale	5	209
Sand	5	214
Shale and clay	22	236
Shale streaks and caliche	3	239
Caliche	45	284
Sand and caliche	3	287
Clay and shale	15	302
Clay	20	322
Sand and clay streaks	64	386
Sand, gravel and clay streaks	10	396
Lime, hard	1	397
Sand and fine gravel	10	407
Sand streaks, hard with gravel and clay	7	414
Sand	10	424
Sand, clay and lime streaks	3	427
Sand streaks, hard with gravel and clay streaks	9	436
Sand streaks, fine with clay and lime	37	473
Sand, fine with clay and lime	6	479
Clay and lime	11	490
Sand and clay streaks	6	496
Clay	25	521

	Thickness (feet)	Depth (feet)
Well LJ-65-21-150--Continued		
Sand and clay streaks	11	532
Clay	2	534
Sand	16	550
Clay and lime streaks	5	555
Sand	7	562
Clay	5	567
Clay and sand	2	569
Sand	13	582
Clay, sand and lime	4	586
Sand and clay streaks	7	593
Clay and lime streaks	2	595
Sand and clay streaks	7	602
Sand, clay and lime streaks	5	607
Sand	6	613
Clay	8	621
Sand and clay streaks	10	631
Clay	14	645

Well LJ-65-21-227
Owner: Harris-Galveston Coastal Subsidence District, Southwest, Well No. 3
Driller: Layne-Western Co., Inc.

	Thickness (feet)	Depth (feet)
Topsoil	2	2
Clay	28	30
Sand	35	65
Clay	25	90
Sand	40	130
Clay	80	210
Sand	50	260
Clay	15	275
Sand	25	300
Clay	38	338
Sand	77	415
Clay	10	425
Well LJ-65-21-227--Continued		
Sand	165	590
Clay	25	615
Sand	85	700
Clay	50	750
Sand	50	800
Clay	20	820
Sand	140	960
Clay	30	990
Sand	30	1,020
Clay	70	1,090
Sand	70	1,160
Clay	30	1,190
Sand	20	1,210
Clay	130	1,340
Sand	15	1,355
Clay	55	1,410
Sand	23	1,433

Well LJ-65-21-228
Owner: Harris-Galveston Coastal Subsidence District, Southwest, Well No. 5
Driller: Layne-Western Co., Inc.

	Thickness (feet)	Depth (feet)
Topsoil	3	3
Clay	28	31
Sand	34	65
Clay	25	90
Sand	38	128
Clay	82	210
Sand	43	253

Well LJ-65-21-229
Owner: Harris-Galveston Coastal Subsidence District, Southwest, Well No. 4
Driller: Layne-Western Co., Inc.

	Thickness (feet)	Depth (feet)
Topsoil	2	2
Clay	29	31
Sand	34	65

WELL LJ-65-12-728--Cont.

Date	Water level
12/05/1983	144.01
01/04/1984	146.26
01/31/1984	145.36
02/28/1984	144.22
03/27/1984	145.73
04/24/1984	145.55
05/22/1984	145.14
06/19/1984	145.00
07/17/1984	146.48
08/14/1984	145.93
09/11/1984	146.83
10/10/1984	145.67
11/06/1984	144.82
12/05/1984	147.50

WELL LJ-65-12-729
OWNER: U.S. GEOLOGICAL SURVEY
SCREEN: 231-237 FEET
ELEVATION: 93 FEET

Date	Water level
01/02/1980	147.09
02/05/1980	146.54
03/04/1980	146.17
04/01/1980	146.25
04/29/1980	146.49
05/27/1980	146.73
06/24/1980	147.26
07/23/1980	147.02
08/19/1980	147.45
09/16/1980	143.90
10/14/1980	144.52
11/10/1980	144.72
12/09/1980	144.58
01/06/1981	144.67
02/04/1981	148.97
03/04/1981	148.34
03/31/1981	148.64
04/29/1981	148.98
05/26/1981	148.55
06/22/1981	148.66
07/20/1981	149.33
08/18/1981	149.76
09/14/1981	149.40
10/13/1981	150.44
11/12/1981	150.62
12/09/1981	150.77
01/05/1982	150.53
02/03/1982	150.66
03/03/1982	150.33
03/30/1982	150.07
04/28/1982	150.15
05/25/1982	150.27
06/22/1982	150.30
07/20/1982	150.46
08/18/1982	152.04
09/14/1982	152.62

WELL LJ-65-12-729--Cont.

Date	Water level
10/14/1982	152.95
11/09/1982	153.03
12/07/1982	153.47
01/04/1983	152.93
02/01/1983	151.98
03/02/1983	150.76
03/29/1983	152.54
04/26/1983	152.13
05/24/1983	151.27
06/21/1983	150.19
07/19/1983	148.66
08/17/1983	148.29
09/14/1983	153.29
10/12/1983	153.80
11/08/1983	153.17
12/05/1983	153.17
01/04/1984	153.54
01/31/1984	153.04
02/28/1984	152.67
03/27/1984	151.88
04/24/1984	151.74
05/22/1984	151.42
06/19/1984	151.88
07/17/1984	152.36
08/14/1984	152.05
09/11/1984	154.55
10/10/1984	153.64
11/06/1984	150.74
12/05/1984	133.69

WELL LJ-65-12-730
OWNER: CITY OF HOUSTON, KATY-ADDICKS, WELL NO. 11
SCREEN: 685-1,692 FEET
ELEVATION: 85 FEET

Date	Water level
01/17/1984	334.30

WELL LJ-65-12-801
OWNER: LAKESIDE COUNTRY CLUB, WELL NO. 2
SCREEN: 280-467 FEET
ELEVATION: 75 FEET

Date	Water level
01/23/1980	163.99
07/03/1980	166.11
09/22/1980	172.53
01/07/1981	171.26
06/09/1981	167.18
09/02/1981	187.35
01/20/1982	179.97
09/09/1982	196.90
01/12/1983	175.82
01/17/1984	174.06

WELL LJ-65-12-806
OWNER: LAKESIDE COUNTRY CLUB, WELL NO. 3
SCREEN: 427-806 FEET
ELEVATION: 70 FEET

Date	Water level
01/23/1980	195.58
01/07/1981	188.08
06/09/1981	188.33
09/02/1981	198.44
01/20/1982	188.56
09/09/1982	200.94
01/12/1983	189.22
01/17/1984	187.86

WELL LJ-65-12-817
OWNER: CITY OF HOUSTON, DISTRICT 71, WELL NO. 3
SCREEN: 597-957 FEET
ELEVATION: 80 FEET

Date	Water level
03/31/1980	276.34

WELL LJ-65-12-904 4H1
OWNER: MEMORIAL VILLAGE, WELL NO. 1
SCREEN: 940-1,555 FEET
ELEVATION: 70 FEET

Date	Water level
01/19/1982	405.00
02/18/1982	404.00
03/17/1982	405.00
04/22/1982	405.00
05/19/1982	412.00
03/18/1983	407.00
05/12/1983	402.00
06/22/1983	405.00
07/21/1983	407.00
08/30/1983	411.00
09/20/1983	414.00

WELL LJ-65-12-917 3H1
OWNER: CITY OF HOUSTON, LAKEVIEW, WELL NO. 3
SCREEN: 333-489 FEET
ELEVATION: 72 FEET

Date	Water level
01/24/1980	198.50
07/07/1980	202.59
09/23/1980	208.31
01/07/1981	205.29
06/10/1981	204.67

WELL LJ-65-13-614
OWNER: CITY OF HOUSTON, HEIGHTS, WELL NO. 3
SCREEN: 514-1,037 FEET
ELEVATION: 68 FEET

Date	Water level
01/07/1980	353.75
02/20/1981	350.20
01/14/1982	355.88
01/10/1983	369.35
01/04/1984	339.60

WELL LJ-65-13-624
OWNER: CITY OF HOUSTON, HEIGHTS, WELL NO. 17
SCREEN: 620-1,720 FEET
ELEVATION: 67 FEET

Date	Water level
01/08/1980	421.00

WELL LJ-65-13-626
OWNER: CITY OF HOUSTON, HEIGHTS, WELL NO. 6A
SCREEN: 665-1,440 FEET
ELEVATION: 68 FEET

Date	Water level
01/10/1983	391.00
01/10/1984	386.00

WELL LJ-65-13-701
OWNER: CITY OF HOUSTON, AFTON OAKS
SCREEN: 680-1,645 FEET
ELEVATION: 72 FEET

Date	Water level
01/23/1980	390.26
01/20/1981	392.50
01/18/1982	415.50
01/31/1983	396.50
01/12/1984	369.35

WELL LJ-65-13-716 3H1
OWNER: HOUSTON COUNTRY CLUB
SCREEN: 520-1,144 FEET
ELEVATION: 63 FEET

Date	Water level
01/29/1980	372.35
07/07/1980	373.20
09/23/1980	389.82
02/10/1981	376.92
09/21/1981	391.66
01/22/1982	377.12
09/09/1982	399.18
01/12/1983	381.04
01/26/1984	378.19

WELL LJ-65-13-801
OWNER: RIVER OAKS COUNTRY CLUB, WELL NO. 2
SCREEN: 617-1,210 FEET
ELEVATION: 52 FEET

Date	Water level
01/30/1980	305.14
07/07/1980	318.05
09/23/1980	329.91
02/10/1981	325.41
06/10/1981	350.57
09/21/1981	344.23
01/22/1982	328.71
09/09/1982	349.22
01/12/1983	330.30
01/26/1984	327.17

WELL LJ-65-13-903
OWNER: CITY OF HOUSTON, CENTRAL, WELL NO. 19
SCREEN: 1,160-1,960 FEET
ELEVATION: 52 FEET

Date	Water level
01/04/1980	403.34
01/19/1982	415.28

WELL LJ-65-13-904
OWNER: CITY OF HOUSTON, CENTRAL, WELL NO. 20
SCREEN: 1,015-1,940 FEET
ELEVATION: 46 FEET

Date	Water level
01/08/1980	430.35
01/26/1981	410.90
01/21/1982	419.09
01/05/1983	421.75
01/09/1984	454.65

WELL LJ-65-13-905
OWNER: CITY OF HOUSTON, CENTRAL, WELL NO. 21
SCREEN: 745-2,000 FEET
ELEVATION: 43 FEET

Date	Water level
01/08/1980	383.80
01/26/1981	384.70
01/11/1983	388.00
01/10/1984	377.00

WELL LJ-65-13-927
OWNER: CITY OF HOUSTON, LINCOLN POOL
DEPTH: 625 FEET
ELEVATION: 45 FEET

Date	Water level
01/24/1980	255.15
02/21/1980	254.81
03/24/1980	252.23

WELL LJ-65-13-927--Cont.

Date	Water level
04/24/1980	253.98
05/23/1980	254.17
06/24/1980	253.06
07/24/1980	260.05
08/22/1980	258.20
09/24/1980	266.57
10/24/1980	265.13
11/24/1980	266.84
12/23/1980	265.43
01/23/1981	260.90
02/24/1981	262.33
03/24/1981	259.62
04/24/1981	260.55
05/22/1981	259.38
06/24/1981	261.07
07/24/1981	261.85
08/24/1981	263.02
09/24/1981	266.81
10/23/1981	267.75
12/01/1981	260.28
12/23/1981	257.15
01/22/1982	259.38
02/24/1982	258.56
03/24/1982	259.13
04/23/1982	259.16
05/24/1982	259.42
06/24/1982	260.75
07/23/1982	269.13
08/23/1982	274.42
09/24/1982	278.66
10/22/1982	274.98
11/24/1982	266.18
12/22/1982	259.87
01/24/1983	253.71
02/24/1983	250.07
03/24/1983	246.81
04/22/1983	247.44
05/23/1983	249.01
06/24/1983	254.31
07/22/1983	256.88
08/24/1983	254.13
09/23/1983	248.97
10/24/1983	245.02
11/25/1983	243.00
12/22/1983	239.11

WELL LJ-65-13-944
OWNER: CITY OF HOUSTON, CENTRAL, WELL NO. 22
SCREEN: 700-1,630 FEET
ELEVATION: 32 FEET

Date	Water level
01/07/1980	370.28
01/26/1981	392.17
01/21/1982	415.37
01/11/1983	401.70
01/09/1984	402.00

Table 3.--Water levels in wells in Harris County--Continued

WELL LJ-65-20-111--Cont.

Date	Water level
01/20/1983	183.68
01/19/1984	184.99

WELL LJ-65-20-203
OWNER: E.W. ANDRAU
SCREEN: 177-693 FEET
ELEVATION: 81 FEET

Date	Water level
03/07/1980	169.95
09/09/1980	182.13
09/18/1980	197.85
06/16/1981	202.71
09/25/1981	207.89
01/29/1982	204.98
09/15/1982	215.53
09/22/1982	213.88
01/20/1983	205.74
01/19/1984	206.65

WELL LJ-65-20-210
OWNER: CITY OF HOUSTON, WALNUT BEND
SCREEN: 334-455 FEET
ELEVATION: 78 FEET

Date	Water level
01/28/1980	198.06
02/18/1981	211.57
01/29/1982	216.17
01/20/1983	219.23
01/19/1984	222.52

WELL LJ-65-20-216
OWNER: CITY OF HOUSTON, LAKESIDE FOREST
SCREEN: 870-1,300 FEET
ELEVATION: 79 FEET

Date	Water level
01/28/1980	348.12
02/18/1981	365.50
01/29/1982	367.83
01/18/1983	369.72
01/19/1984	371.46

WELL LJ-65-20-218
OWNER: CITY OF HOUSTON, WALNUT BEND, WELL NO. 2
SCREEN: 660-1,265 FEET
ELEVATION: 79 FEET

Date	Water level
01/28/1980	305.40
02/10/1981	327.94
01/29/1982	328.25
01/18/1983	330.17
01/19/1984	332.59

WELL LJ-65-20-225
OWNER: CITY OF HOUSTON, DISTRICT 71, WELL NO. 1
SCREEN: 1,054-1,350 FEET
ELEVATION: 80 FEET

Date	Water Level
03/31/1980	356.02
09/15/1981	385.30
01/29/1982	382.09
09/22/1982	386.97
01/18/1983	382.06
01/26/1984	368.18

WELL LJ-65-20-301 1MI
OWNER: CITY OF HOUSTON, SOUTHWEST, WELL NO. 6
SCREEN: 548-1,360 FEET
ELEVATION: 71 FEET

Date	Water Level
01/14/1980	386.00
01/14/1981	394.00
01/15/1982	398.00

WELL LJ-65-20-302 1MI
OWNER: CITY OF HOUSTON, SOUTHWEST, WELL NO. 7
SCREEN: 490-1,440 FEET
ELEVATION: 71 FEET

Date	Water Level
01/14/1980	355.00
01/14/1981	372.00
01/08/1982	390.36
01/28/1983	406.08
01/06/1984	396.94

WELL LJ-65-20-303 1MI
OWNER: CITY OF HOUSTON, SOUTHWEST, WELL NO. 8
SCREEN: 560-1,445 FEET
ELEVATION: 73 FEET

Date	Water Level
01/14/1980	337.25
01/16/1981	344.85
01/08/1982	352.01
01/31/1983	348.96
01/06/1984	346.20

WELL LJ-65-20-304 1MI
OWNER: CITY OF HOUSTON, SOUTHWEST, WELL NO. 11
SCREEN: 755-1,552 FEET
ELEVATION: 74 FEET

Date	Water Level
01/15/1980	379.00
01/14/1981	390.00
01/15/1982	396.00

WELL LJ-65-20-307 1MI
OWNER: CITY OF HOUSTON, DISTRICT 34, WELL NO. 2
SCREEN: 624-881 FEET
ELEVATION: 74 FEET

Date	Water level
01/28/1980	327.49
06/26/1980	336.34
09/09/1980	346.10
09/18/1980	360.18
02/10/1981	343.79
06/16/1981	364.38
09/03/1981	334.74
01/28/1982	333.53
09/15/1982	370.45
01/19/1983	338.62
01/19/1984	341.26

WELL LJ-65-20-309 2MI
OWNER: CITY OF HOUSTON, DISTRICT 52, WELL NO. 1
SCREEN: 586-896 FEET
ELEVATION: 75 FEET

Date	Water level
01/28/1980	321.26
02/10/1981	331.77
01/28/1982	334.11
01/18/1983	332.98
01/19/1984	335.13

WELL LJ-65-20-319 1MI
OWNER: CITY OF HOUSTON, DISTRICT 54, WELL NO. 2
SCREEN: 630-1,370 FEET
ELEVATION: 72 FEET

Date	Water level
01/28/1980	391.25
01/16/1981	405.23
01/19/1982	422.42
01/26/1983	428.03
02/03/1984	391.92

WELL LJ-65-20-322 2MI
OWNER: CITY OF HOUSTON, WINDSWEPT, WELL NO. 1
SCREEN: 658-1,520 FEET
ELEVATION: 75 FEET

Date	Water level
01/28/1980	366.49
02/18/1981	379.00
01/19/1983	394.26
02/13/1984	387.81

Table 3.--Water levels in wells in Harris County--Continued

WELL LJ-65-20-405
OWNER: CITY OF HOUSTON, BELLAIRE-BRAYS, WELL NO. 1
SCREEN: 640-1,620 FEET
ELEVATION: 81 FEET

Date	Water level
02/20/1980	280.71
01/06/1981	298.52
01/06/1982	290.70
01/21/1983	294.67
02/01/1984	299.12

WELL LJ-65-20-407
OWNER: CITY OF HOUSTON, BELLAIRE-BRAYS, WELL NO. 4
SCREEN: 618-1,634 FEET
ELEVATION: 85 FEET

Date	Water level
02/20/1980	295.56
01/06/1981	288.39
01/04/1982	282.31
01/21/1983	284.59
02/01/1984	293.62

WELL LJ-65-20-408
OWNER: CITY OF HOUSTON, BELLAIRE-BRAYS, WELL NO. 5
SCREEN: 639-1,583 FEET
ELEVATION: 85 FEET

Date	Water level
02/20/1980	316.40
01/06/1981	316.18
01/21/1983	319.10
02/03/1984	328.72

WELL LJ-65-20-409
OWNER: CITY OF HOUSTON, BELLAIRE-BRAYS, WELL NO. 3
SCREEN: 609-1,551 FEET
ELEVATION: 75 FEET

Date	Water level
02/20/1980	275.13
01/06/1981	292.25
01/06/1982	292.70
01/21/1983	295.67
02/03/1984	303.52

WELL LJ-65-20-507 4H1
OWNER: WESTWOOD COUNTRY CLUB
SCREEN: 895-1,044 FEET
ELEVATION: 71 FEET

Date	Water level
01/26/1982	263.50
02/18/1982	267.50
03/17/1982	265.50

WELL LJ-65-20-507--Cont.

Date	Water Level
04/22/1982	262.50
05/19/1982	275.50
06/17/1982	270.00
07/21/1982	278.00
09/20/1982	288.00
12/22/1982	265.00
01/11/1983	272.00
03/03/1983	270.00
03/17/1983	263.00
05/12/1983	264.00
06/22/1983	269.00
07/21/1983	271.00
08/30/1983	274.00
09/20/1983	278.00
10/21/1983	273.00
11/09/1983	270.00

WELL LJ-65-20-513
OWNER: CITY OF HOUSTON, BELLAIRE-BRAYS, WELL NO. 2
SCREEN: 649-1,631 FEET
ELEVATION: 75 FEET

Date	Water Level
02/20/1980	297.09
01/06/1981	310.86
01/04/1982	307.19
01/21/1983	309.10
02/01/1984	320.16

WELL LJ-65-20-602 2H1
OWNER: CITY OF HOUSTON, SHARPSTOWN, WELL NO. 1
SCREEN: 595-950 FEET
ELEVATION: 70 FEET

Date	Water Level
01/14/1980	308.50
06/26/1980	305.50
09/18/1980	326.50
02/13/1981	314.50
09/18/1981	330.50
01/28/1982	316.50
09/15/1982	333.50
01/19/1983	318.50
01/26/1984	316.00

WELL LJ-65-20-603 2H1
OWNER: CITY OF HOUSTON, SHARPSTOWN, WELL NO. 2
SCREEN: 584-989 FEET
ELEVATION: 76 FEET

Date	Water Level
01/14/1980	303.80
02/13/1981	310.09
01/28/1982	312.68
09/22/1982	317.43
01/19/1983	314.05
01/26/1984	311.92

WELL LJ-65-20-608 2H1
OWNER: CITY OF HOUSTON, SHARPSTOWN, WELL NO. 3
SCREEN: 605-1,520 FEET
ELEVATION: 70 FEET

Date	Water level
01/14/1980	305.27
01/07/1981	316.94

WELL LJ-65-20-614 2H1
OWNER: CITY OF HOUSTON, SHARPSTOWN, WELL NO. 4
SCREEN: 579-1,495 FEET
ELEVATION: 76 FEET

Date	Water level
01/14/1980	327.19
01/07/1981	337.20
01/19/1982	347.82
01/26/1983	351.23
02/03/1984	361.70

WELL LJ-65-20-617 4H1
OWNER: CITY OF HOUSTON, BRAEBURN VALLEY, WELL NO. 1
SCREEN: 490-700 FEET
ELEVATION: 68 FEET

Date	Water level
02/05/1980	257.45
06/26/1980	265.00
09/25/1980	274.13
01/08/1981	276.64
06/15/1981	286.63
09/18/1981	291.70
01/28/1982	290.46
09/17/1982	299.38
01/17/1983	290.29
01/26/1984	288.11

WELL LJ-65-20-618 4H1
OWNER: CITY OF HOUSTON, BRAEBURN VALLEY, WELL NO. 2
SCREEN: 885-1,325 FEET
ELEVATION: 70 FEET

Date	Water level
02/20/1980	318.00
02/12/1981	328.60
09/25/1981	341.11
01/28/1982	336.74
09/15/1982	353.66
01/17/1983	338.85
01/26/1984	335.50

WELL LJ-65-20-619
OWNER: CITY OF HOUSTON, BRAESWOOD, WELL NO. 1
SCREEN: 690-1,755 FEET
ELEVATION: 60 FEET

Date	Water level
02/07/1980	323.87
01/07/1981	350.82
01/07/1982	339.41
01/05/1983	346.26

WELL LJ-65-20-908
OWNER: CITY OF HOUSTON, BRAEBURN WEST
SCREEN: 627-908 FEET
ELEVATION: 73 FEET

Date	Water level
02/05/1980	273.79
06/26/1980	276.76
01/08/1981	288.60
06/16/1981	302.15
09/02/1981	335.23
01/28/1982	332.10
09/15/1982	343.86
01/17/1983	329.94
01/26/1984	327.74

WELL LJ-65-20-910
OWNER: CITY OF HOUSTON, SIMS BAYOU, WELL NO. 5
SCREEN: 610-1,188 FEET
ELEVATION: 70 FEET

Date	Water level
01/29/1980	271.25
01/12/1981	283.45
01/19/1982	301.66
01/07/1983	302.42
01/17/1984	302.25

WELL LJ-65-20-911
OWNER: CITY OF HOUSTON, SIMS BAYOU, WELL NO. 4
SCREEN: 645-1,185 FEET
ELEVATION: 70 FEET

Date	Water level
01/29/1980	273.72
01/12/1981	283.89
01/19/1982	303.72
01/07/1983	302.53
01/16/1984	300.11

WELL LJ-65-21-102 3M1
OWNER: CITY OF HOUSTON, SOUTHWEST, WELL NO. 2
SCREEN: 657-1,473 FEET
ELEVATION: 64 FEET

Date	Water level
01/22/1981	415.72

WELL LJ-65-21-102--Cont.

Date	Water Level
01/11/1982	427.77

WELL LJ-65-21-104 ZM1
OWNER: CITY OF HOUSTON, SOUTHWEST, WELL NO. 4
SCREEN: 692-1,490 FEET
ELEVATION: 66 FEET

Date	Water Level
01/14/1980	381.00

WELL LJ-65-21-143 4M1
OWNER: CITY OF HOUSTON, SOUTHWEST, WELL NO. 1A
SCREEN: 716-1,492 FEET
ELEVATION: 64 FEET

Date	Water Level
01/15/1980	402.94
01/16/1981	414.18
01/11/1982	436.04
01/25/1983	405.54
01/05/1984	382.59

WELL LJ-65-21-144 ZM1
OWNER: CITY OF HOUSTON, SOUTHWEST, WELL NO. 5
SCREEN: 652-1,380 FEET
ELEVATION: 69 FEET

Date	Water Level
01/15/1980	398.00
01/16/1981	416.00
01/11/1982	428.11
01/28/1983	397.14
01/06/1984	397.94

WELL LJ-65-21-149 ZM1
OWNER: CITY OF HOUSTON, SOUTHWEST, WELL NO. 4A
SCREEN: 690-1,498 FEET
ELEVATION: 69 FEET

Date	Water Level
01/09/1984	407.00

WELL LJ-65-21-150 ZM1
OWNER: CITY OF HOUSTON, SOUTHWEST, WELL NO. 3SB
SCREEN: 330-631 FEET
ELEVATION: 64 FEET

Date	Water Level
01/16/1984	339.00

WELL LJ-65-21-201
OWNER: CITY OF HOUSTON, SOUTHWEST, WELL NO. 9
SCREEN: 554-1,031 F
ELEVATION: 63 FEET

Date	Water level
01/14/1980	311.84
01/16/1981	317.48
01/08/1982	329.52
01/24/1983	321.26
01/05/1984	311.95

WELL LJ-65-21-226
OWNER: HARRIS-GALVESTON COASTAL SUBSIDENCE DISTRICT, SOUTHWEST, WELL NO. 1
SCREEN: 2,316-2,336 FEET
ELEVATION: 64 FEET

Date	Water level
02/13/1980	308.28
02/21/1980	299.70
03/12/1980	303.10
04/10/1980	304.77
05/06/1980	305.07
05/28/1980	305.16
06/24/1980	303.89
07/23/1980	304.10
08/19/1980	305.42
09/16/1980	301.45
10/14/1980	300.97
11/10/1980	297.47
12/09/1980	295.37
01/06/1981	294.91
02/05/1981	294.30
03/05/1981	301.65
03/31/1981	304.35
04/28/1981	302.43
05/26/1981	302.71
06/22/1981	303.06
07/20/1981	310.08
08/18/1981	310.44
09/15/1981	310.72
10/13/1981	311.32
11/13/1981	313.23
12/08/1981	313.64
01/06/1982	312.61
02/02/1982	312.85
03/03/1982	313.14
03/30/1982	313.42
04/28/1982	313.88
05/25/1982	313.94
06/22/1982	313.92
07/20/1982	314.05
08/17/1982	314.57
09/14/1982	315.39
10/14/1982	315.94
11/09/1982	317.02
12/07/1982	317.56
01/04/1983	318.48
02/01/1983	318.62
03/02/1983	318.47

Table 3.--Water levels in wells in Harris County--Continued

WELL ~~LJ-65-21-402~~ 4H1\
OWNER: CITY OF BELLAIRE, WELL NO. 3
SCREEN: 1,200-1,570 FEET
ELEVATION: 59 FEET

Date	Water level
01/31/1980	397

WELL LJ-65-21-403
OWNER: CITY OF HOUSTON, MEYERLAND, WELL NO. 1
SCREEN: 710-1,770 FEET
ELEVATION: 56 FEET

Date	Water level
01/25/1980	324
01/07/1981	311
01/07/1982	372
01/05/1983	368

WELL LJ-65-21-404
OWNER: CITY OF HOUSTON, MEYERLAND, WELL NO. 22
SCREEN: 618-1,198 FEET
ELEVATION: 61 FEET

Date	Water level
01/25/1980	268
01/07/1981	320.04
01/04/1982	315.93
01/05/1983	318.77
01/06/1984	316.14

WELL LJ-65-21-413
OWNER: CITY OF BELLAIRE, WELL NO. 1
SCREEN: 651-708 FEET
ELEVATION: 59 FEET

Date	Water level
01/14/1980	298.49
06/26/1980	300.09
09/18/1980	315.04
02/12/1981	298.30
06/16/1981	300.93
09/18/1981	316.26
01/22/1982	299.42
09/15/1982	321.17
01/18/1983	300.38
01/26/1984	298.89

WELL ~~LJ-65-21-414~~ 4H1\
OWNER: CITY OF HOUSTON, BRAESWOOD, WELL NO. 2
SCREEN: 620-1,735 FEET
ELEVATION: 66 FEET

Date	Water level
02/07/1980	342.29
01/07/1981	330.88
01/07/1982	355.83
01/05/1983	349.60
01/05/1984	343.26

WELL LJ-65-21-503
OWNER: CITY OF HOUSTON, LINKWOOD, WELL NO. 1
SCREEN: 770-1,840 FEET
ELEVATION: 52 FEET

Date	Water Level
01/10/1980	337
01/23/1981	335
01/15/1982	341
01/04/1983	344
01/04/1984	342

WELL LJ-65-21-504
OWNER: CITY OF HOUSTON, LINKWOOD, WELL NO. 2
SCREEN: 735-2,260 FEET
ELEVATION: 52 FEET

Date	Water Level
01/10/1980	369.03
01/16/1981	373.52
01/07/1982	368.70
01/04/1983	376.18
01/04/1984	372.91

WELL LJ-65-21-507
OWNER: CITY OF HOUSTON, WILLOW MEADOWS
SCREEN: 557-799 FEET
ELEVATION: 60 FEET

Date	Water Level
06/26/1980	271.50
09/25/1980	289.02
02/12/1981	291.10
06/15/1981	299.01
09/18/1981	305.54
01/25/1982	304.83
09/17/1982	308.52
01/17/1983	302.11
01/26/1984	298.86

WELL LJ-65-21-509
OWNER: CITY OF HOUSTON, LINKWOOD, WELL NO. 3
SCREEN: 725-1,860 FEET
ELEVATION: 51 FEET

Date	Water Level
01/14/1980	351.71
01/16/1981	358.95
01/19/1982	356
01/04/1983	360.04
01/04/1984	357.27

WELL LJ-65-21-703
OWNER: CITY OF HOUSTON, WESTBURY
DEPTH: 271 FEET
ELEVATION: 66 FEET

Date	Water Level
01/25/1980	139.05
09/17/1980	152.17

WELL LJ-65-21-703--Cont.

Date	Water level
01/03/1983	137.93
01/05/1984	136.58

WELL LJ-65-21-707
OWNER: CITY OF HOUSTON, WESTBURY, WELL NO. 3
SCREEN: 653-1,765 FEET
ELEVATION: 66 FEET

Date	Water level
01/25/1980	304.84
01/07/1981	329.56
01/03/1983	351.62

WELL LJ-65-21-708
OWNER: CITY OF HOUSTON, SIMS BAYOU, WELL NO. 3
SCREEN: 632-1,180 FEET
ELEVATION: 65 FEET

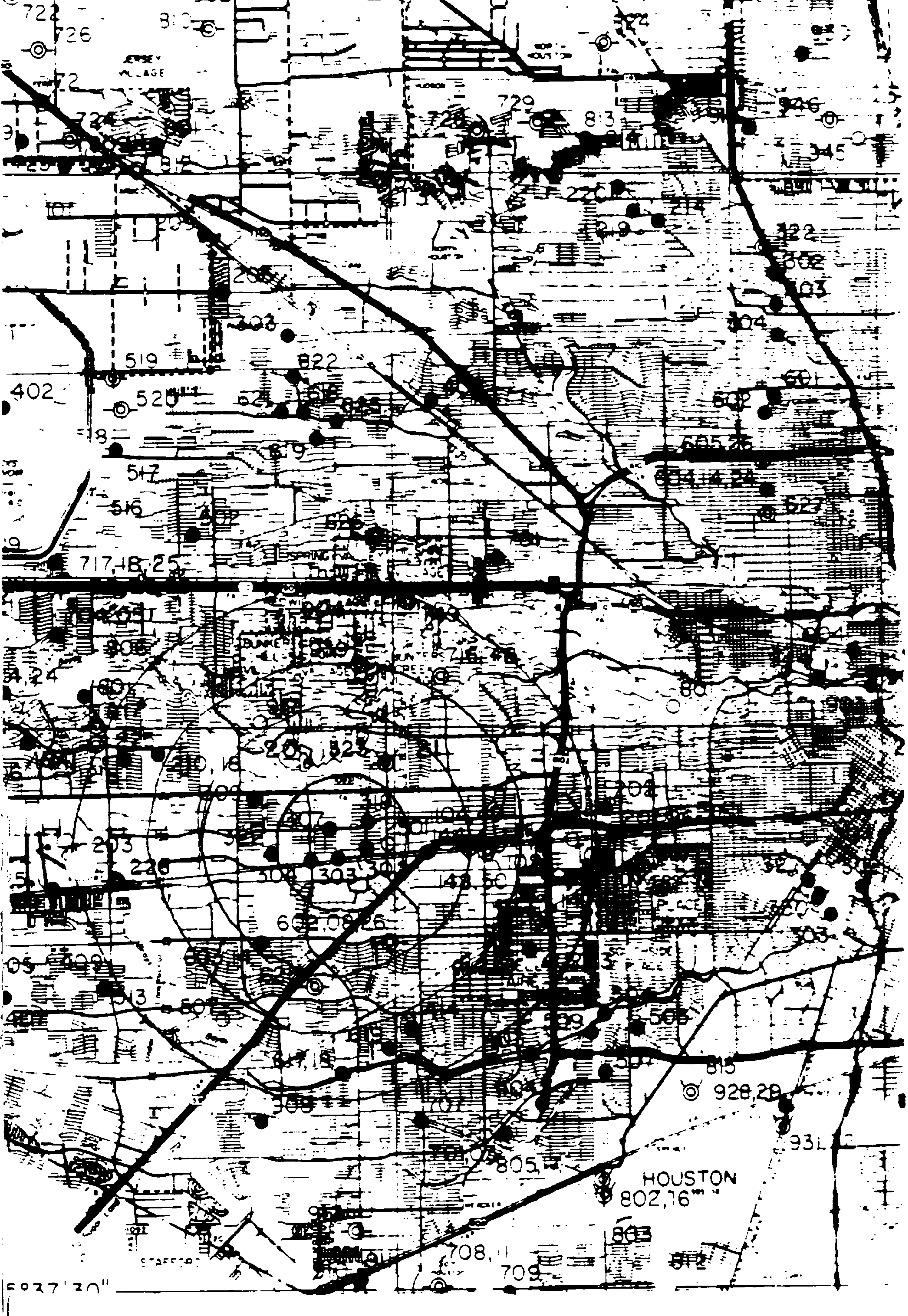
Date	Water level
01/30/1980	279.70
01/12/1981	286.05
01/19/1982	306.82
01/07/1983	309.29
01/16/1984	307.93

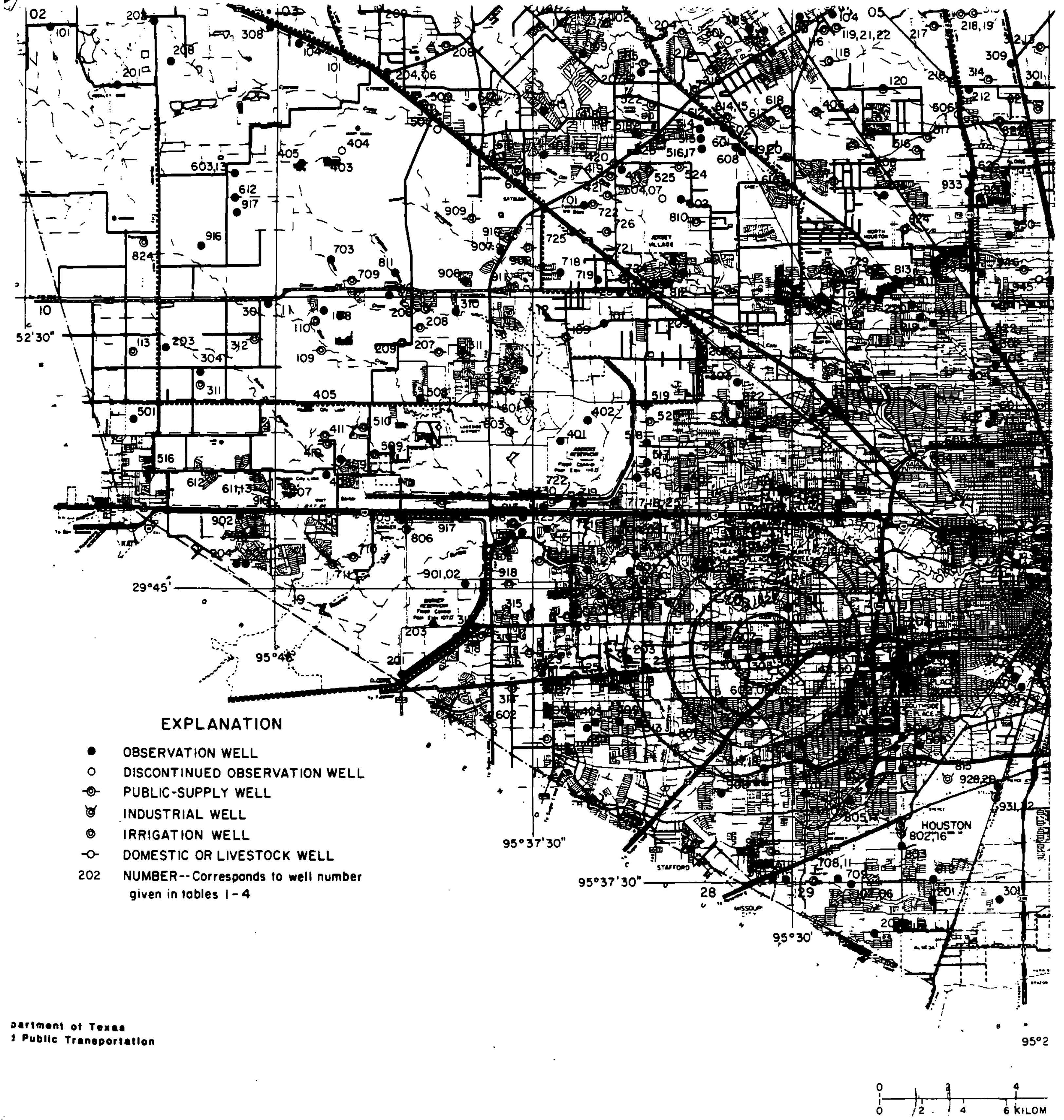
WELL LJ-65-21-709
OWNER: CITY OF HOUSTON, SIMS BAYOU, WELL NO. 2
SCREEN: 644-1,169 FEET
ELEVATION: 65 FEET

Date	Water level
01/30/1980	280.87
01/12/1981	293.82
01/19/1982	310.66
01/04/1983	312.17
01/16/1984	311.04

WELL LJ-65-21-802
OWNER: HOUSTON LIGHTING AND POWER CO., HIRAM CLARK, WELL NO. 2
SCREEN: 895-1,263 FEET
ELEVATION: 67 FEET

Date	Water level
01/03/1980	339
01/25/1980	334
09/29/1980	358
11/12/1980	351
12/08/1980	359
01/12/1981	351
02/10/1981	346
03/05/1981	347
04/03/1981	349
05/04/1981	351
06/15/1981	351
07/28/1981	352

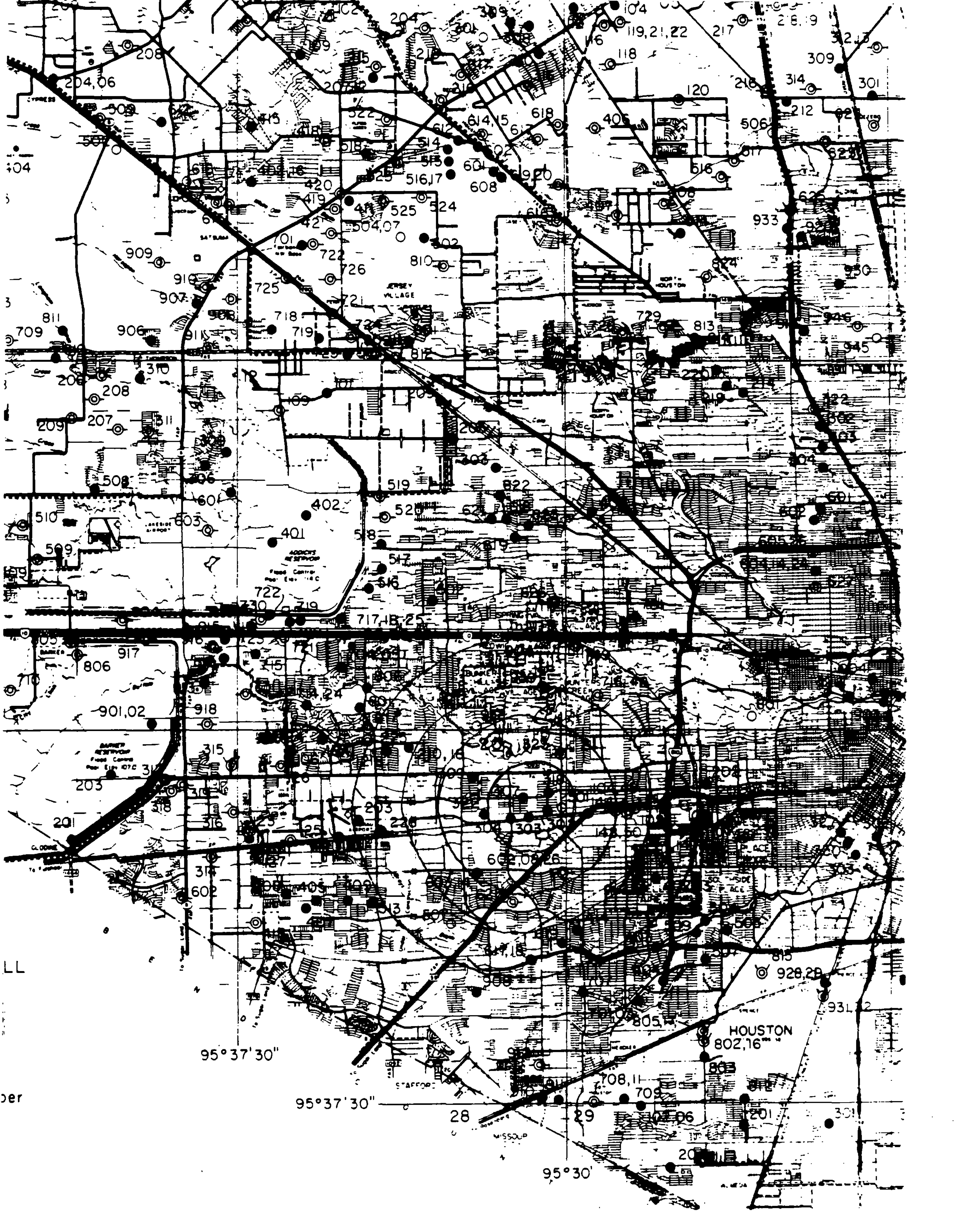

JERSEY VILLAGE
HOUSTON
802,16
928,29
815
717,18,25
602,03,26
402
519
520
517
516
203
226
513
303
729
813
946
345
627
805
708
709
803
STAFFORD
5°37'30"



partment of Texas
Public Transportation

Figure 1.

Location of wells in Harris County.



JERSEY VILLAGE
NORTH HOUSTON
HOUSTON
STAFFORD
MISSOURI
95°37'30"
95°37'30"
95°30'
28
29
LL
per

PA-SCORE

REFERENCE 10

RECORD OF COMMUNICATION

TYPE: Outgoing Phone Call **DATE:** 5-12-92 **TIME:** 8:50 p.m.

TO: Mike Montgomery
Water Manager
Memorial Villages Water Authority
Houston, Texas
713-465-8318

FROM: Kevin Jaynes
Site Manager
ICF Technology, Inc.
214-979-3900

SUBJECT: Memorial Villages Water Authority, West Houston

SUMMARY OF COMMUNICATION:

The Memorial Villages Water Authority operates 6 wells with 3 plants.

Well No. 1 (b) (9) [redacted], 2 blocks south of I-10 between Campbell Road (to the west) and Brogden (to the east)

Well No. 2 (b) (9) [redacted], 2½ blocks south of I-10 between Piney Point Road (to the west) and Campbell Road (to the east)

Well No. 3 (identified as 939) (b) (9) [redacted], between Claymore and Greenbay, west of Piney Point.

Well No. 4 (b) (9) [redacted], bounded by Memorial Drive to the south and by Kuhlman to the west. 2,500 feet wouth of I-10.

Well No. 5 (b) (9) [redacted]

Well No. 6 (b) (9) [redacted], 1½ blocks south of I-10, bounded by Piney Point (to the east) and Echo Lane (to the west).

Water Plant #1 at Gaylord has 2 tanks and Wells #1, #2, and #6 pump to this location.

Water Plant #2 at 435 Piney Point; Wells #3 and #5 pump to it.

Water Plant #3 at 739 West Creekside; Well #4.

The system is interconnected or blended. Serving Hedwig Village, Hunter Creek Village, and Piney Point Village. The system is a 100% ground water system.

Bunker Hill village operates their own system. Call David Eby, City Administrator, 713-467-9762.

All the Memorial Village wells tap the Evangeline Aquifer and average 1,400 feet in depth.

Total population served from 1990 census is 10,028 with 3,045 connections as of April 1992.

Flow Quantities: for May 1, 1991 to April 30, 1992

Total: 1,047,378,000 gallons

#1 Gaylord Plant: 280,558,000 gallons

#2 Piney Point Plant: 589,957,000 gallons

#3 Creekside: 176,863,000 gallons

Pumpage per well. Concerned with 40% of total.
The three largest wells are as follows:

Well #1: 95,793,000 gallons

Well #3: 309,036,000 gallons

Well #5: 280,921,000 gallons

The remaining 3 wells usually pump less than any of these.

PA-SCORE

REFERENCE 11

RECORD OF COMMUNICATION

TYPE: Outgoing Phone Call **DATE:** 5-12-92 **TIME:** 2:05 p.m.

TO: David Eby
City Administrator
Bunker Hill Village
713-467-9762

FROM: Kevin Jaynes
Site Manager
ICF Technology, Inc.
214-979-3900

SUBJECT: Bunker Hill Village Municipal Water System

SUMMARY OF COMMUNICATION:

Mr. Eby stated that there are four wells, two of which are 8 inch diameter and two 6 inch diameter, average 1,200 to 1,400 feet deep screening the Evangeline Aquifer.

The system is blended or interconnected with 3,300 people served and is strictly residential. The system is a 100% ground water system.

Well #1 located at (b) (9) [redacted]

Well #2 and #3 located at (b) (9) [redacted]

Well #4 located at (b) (9) [redacted]

No single well produces 40% of the total water distributed.

Bunker Hill is not part of the Texas Wellhead Protection Program as yet but is planning to establish.

Summary: 3,300 people/4 wells = 825 people per well

PA-SCORE

REFERENCE 12

REFERENCE 12

FOUR MILE TARGET DISTANCE LIMIT

METAL COATINGS CORPORATION

HOUSTON, TEXAS

TXD072181969

N

0 2000

SCALE 1 : 24000

TEXAS

QUADRANGLES

ALIEF, TX

BELLAIRE, TX

HEDWIG VILLAGE, TX

HOUSTON HEIGHTS, TX

PA-SCORE

REFERENCE 13

John Hall, Chairman
B. J. Wynne, III, Commissioner
John E. Birdwell, Commissioner

TEXAS WATER COMMISSION

PROTECTING TEXANS' HEALTH AND SAFETY BY PREVENTING AND REDUCING POLLUTION

July 15, 1991

Mr. Alex Zocchi
ICF Kalser Engineers
1509 Main Street
Suite 900
Dallas, Texas 75201

Re: Texas' Wellhead Protection (WHP) Program

Dear Mr. Zocchi:

I would like to thank you for your recent inquiry on Texas' WHP Program. The program is jointly administered by the Texas Water Commission (lead agency) and the Texas Department of Health (TDH). On June 19, 1989, the State of Texas submitted its WHP program description to the Environmental Protection Agency (EPA), pursuant to Section 1428 of the Safe Drinking Water Act (SDWA), as amended in 1986. Under Section 1428, EPA is required to evaluate each State program to determine whether it is adequate to protect public water supply (PWS) wells from contaminants that may have any adverse effects on public health. On March 19, 1990, Texas' WHP Program was fully approved by EPA for the purposes of Section 1428 of the SDWA. Because the program description is approximately 300 pages long, I will be happy to provide you with highlights and requirements contained within our program description.

Designation of a restricted use area around a public drinking water well is one way of protecting underground water supplies. This area is referred to as a wellhead protection area and it is defined as the surface and subsurface area surrounding a public water well or well field through which contaminants could likely pass and eventually reach the ground water supply.

The basic concept of the program is the minimization of land use restrictions while maximizing ground water protection. To accomplish this, the Texas Water Commission (TWC) delineates WHP areas based on aquifer parameters, a five-year travel time for potential contaminants, and best professional judgement to prevent ground water contamination. The TDH reviews contingency plans for the provision of alternate water supplies in the event of contamination of the existing source. Local governments provide an inventory of all potential sources of contaminants within their WHP areas; then they implement the program. Guidance to local governments with respect to the inventory of potential contaminant sources, and other required technical assistance as needed, is provided by the TWC and the TDH.

P.O. Box 13087 Capitol Station • 1700 North Congress Avenue • Austin, Texas 78711-3087 • 512/463-7830

Since Section 26.177 of the Texas Water Code requires that every city of the state having a population of 5,000 inhabitants or more establish a water pollution control and abatement program for the city which includes the inventorying and monitoring of potential contamination sources, the TWC encourages formal participation in the WHP program. Formal participation involves: 1) the TWC providing official WHP area delineations; 2) the entity conducting an inventory of all potential contaminant sources; 3) the TWC and the TDH preparing an official report which is used to brief the participating entity; 4) the entity then enacting appropriate best management practices to prohibit or control the inventoried sources which are a threat to ground water; and 5) lastly, the entity conducting a re-inventory of potential pollution sources at two to five year intervals which is provided to the sate for updating purposes.

An entity which participates in the program realizes immediate benefits in that it is assured that its ground water supply is better protected form the many potential contaminant sources. As additional incentive, those PWS systems which can demonstrate a lower risk from potential contamination may be granted reduced well monitoring requirements by the TDH.

I hope this brief overview has helped you understand how our program functions. In addition, I have enclosed a list of communities currently participating in wellhead protection. Should you have any questions, please feel free to contact me at 512/371-6332.

Sincerely,

David P. Terry, M.En.
Ground Water Section

DPT:km

Enclosure

WELLHEAD PROTECTION PROGRAM ASSESSMENT

CITY	# OF WELLS	# OF WHP AREAS	START DATE	RPT DATE
Alamo,City of	2	1	09/20/89	/ /
Alvin,City of	5	3	02/07/88	/ /
Amarillo,City of	106	0	06/07/89	/ /
Atlanta,City of	4	2	12/06/89	08/15/90
Bardwell,City of	2	1	06/06/91	/ /
Bartlett,City of	2	2	04/26/89	08/30/90
Bartonville Water Supply Corp.	4	3	09/15/89	/ /
Bay City,City of	6	5	05/04/89	08/15/90
Beaumont,City of	3	3	01/17/89	/ /
Benbrook,City of	16	10	04/02/91	/ /
Bethany Water Supply Corp	6	2	05/24/91	/ /
Bevil Oaks,City of	2	1	01/17/89	08/08/90
Brazoria,City of	3	2	01/17/89	08/30/90
Bridge City,City of	3	2	01/17/89	/ /
Bryan,City of	8	8	10/27/88	/ /
Buckholts,City of	1	1	01/17/89	08/30/90
Carrollton,City of	1	1	11/10/89	/ /
Charterwood M.U.D.	2	1	10/03/89	/ /
China,City of-	3	1	01/17/89	/ /
Claude,City of	4	4	05/25/89	/ /
Clear Lake,City of	6	2	04/18/90	05/01/91
Cleveland,City of	5	3	12/01/88	/ /
Colony,The	7	4	04/22/91	/ /
Commerce,City of	7	7	04/02/91	/ /
Cumby,City of	4	1	07/05/89	08/01/90
Deer Park,City of	3	3	03/20/89	08/31/90
Del Rio,City of	4	1	10/01/86	12/01/86
Desoto,City of	1	1	05/09/91	/ /
Devine,City of	6	6	10/27/88	/ /
Dimmitt,City of	13	0	06/07/89	/ /
Dumas,City of	13	13	06/07/88	12/01/88
Eagle Bluff Assoc. Inc.	2	1	05/02/89	06/30/89
El Paso,City of	137	44	11/01/89	05/01/90
Eldorado Air Force Station	2	2	03/24/89	/ /
Fayette WSC	4	4	10/10/89	08/08/90
Flo Community WSC	3	2	10/27/88	08/08/90
Fort Bliss	14	10	01/15/90	07/20/90
Friendswood,City of	6	6	12/11/89	/ /
Friona,City of	11	3	06/07/89	/ /
Frost,City of	2	1	04/02/91	/ /
Gause,City of	1	1	01/17/89	08/31/90
George West,City of	2	1	04/16/90	/ /
Grand Prairie,City of	12	12	03/01/89	/ /
Groom,City of	2	2	07/12/88	12/01/88
Gruver,City of	2	1	06/07/89	/ /
Gunter Rural Water Supply Corp	3	2	06/06/91	/ /
Haslet,City of	3	2	06/06/91	/ /
Hereford,City of	29	0	05/17/89	/ /
Hildalgo,City of	3	1	01/17/89	/ /

WELLHEAD PROTECTION PROGRAM ASSESSMENT

CITY	# OF WELLS	# OF WHP AREAS	START DATE	RPT DATE
Houston,City of	214	0	06/06/90	/ /
Hurst,City of	6	6	10/27/88	05/25/89
Irving,City of	5	5	10/27/88	01/04/91
Jacksonville,City of	5	2	09/12/89	/ /
Johnson Co. Fresh Water Dist.1	7	3	06/06/91	/ /
Jourdanton,City of	3	3	10/27/88	/ /
Katy,City of	5	5	05/24/88	12/01/88
Keller,City of	11	6	05/09/91	/ /
Kennedale,City of	4	4	12/21/87	04/01/88
Kilgore,City of	9	9	10/27/88	/ /
Kingwood,City of	8	8	10/27/88	/ /
Kirby,City of	2	1	10/10/89	/ /
Kountze,City of	2	1	01/17/89	/ /
Kress,City of	4	2	07/19/89	/ /
Lamar I.S.D.	3	3	05/24/88	12/01/88
Lamesa,City of	8	1	10/10/89	/ /
Little Elm,Town of	8	4	04/22/91	/ /
Lumberton,City of	3	3	01/17/89	/ /
Maloy Water Supply Corporation	1	1	06/06/91	/ /
Marlow WSC	0	2	01/17/89	08/08/90
Martindale,City of	1	1	05/02/89	/ /
McLean,City of	4	4	07/12/88	12/01/88
Meeker,City of	2	1	01/17/89	/ /
Mercedes,City of	1	1	09/20/89	/ /
Midlothian,City of	2	2	05/21/91	/ /
Milano WSC	2	2	01/17/89	08/15/90
Military Highway WSC	2	2	10/10/89	/ /
Mineola,City of	3	3	10/10/89	/ /
Minerva WSC	2	2	01/17/89	08/08/90
Nash,City of	2	2	05/18/89	11/01/89
New Caney,City of	2	2	11/15/90	/ /
North Milam WSC	4	4	01/17/89	/ /
North Shore Water Supply Corp	2	2	05/09/91	/ /
Orange Grove,City of	2	2	10/27/88	02/01/90
Orange,City of	4	3	01/17/89	/ /
Ovilla Community System	2	1	04/22/91	/ /
Panhandle,City of	3	3	07/12/88	12/01/88
Panola,City of	2	2	01/17/89	/ /
Pantego,City of	6	2	05/24/91	/ /
Perryton,City of	11	11	06/07/88	12/01/88
Pinehurst,City of	2	1	01/17/89	/ /
Pinewood,City of	2	2	01/17/89	/ /
Plainview,City of	16	1	10/27/88	/ /
Pleasanton,City of	9	9	10/27/88	/ /
Porter W.S.C.	5	5	10/23/90	/ /
Poth,City of	2	2	10/27/88	08/08/90
Quail Valley Util. Dist.	4	4	10/27/88	/ /
Queen City,City of	1	1	05/15/90	08/30/90
Quitaque,City of	2	1	03/08/91	/ /

WELLHEAD PROTECTION PROGRAM ASSESSMENT

CITY	# OF WELLS	# OF WHP AREAS	START DATE	RPT DATE
Red Oak,City of	5	2	05/09/91	/ /
Redwater,City of	2	2	05/17/89	01/01/90
Refugio,City of	3	2	02/23/90	/ /
Rockdale,City of	5	5	01/17/89	08/31/90
Rocksprings,City of	2	2	10/27/88	/ /
Rosenberg,City of	5	5	05/24/88	12/01/88
Salado W.S.C.	4	1	08/23/90	/ /
San Marcos,City of	4	2	10/27/88	/ /
Shallowater,City of	7	1	04/23/90	/ /
Shenandoah,City of	2	2	10/16/90	/ /
Silsbee,City of	3	3	01/17/89	08/10/90
Sinton,City of	3	3	10/27/88	02/01/90
Skellytown,Town of	4	4	05/31/89	/ /
Smithville,City of	3	1	10/27/88	/ /
Sonora,City of	5	1	12/20/89	/ /
Sour Lake,City of	2	2	01/17/89	/ /
Southwest Milam WSC	5	5	01/17/89	08/30/90
Spearman,City of	5	3	03/07/91	/ /
Stephenville,City of	29	17	04/22/91	/ /
Sterling,City of	9	4	10/27/88	/ /
Stinnett,City of	2	0	05/18/89	/ /
Sugarland,City of	7	4	01/17/89	/ /
Sweeny,City of	3	1	09/01/89	11/01/89
Tyler,City of	13	13	10/27/88	/ /
Venus,City of	2	2	04/02/91	/ /
Victoria,City of	15	12	10/15/90	/ /
Vidor,City of	3	3	01/17/89	/ /
West Orange,City of	2	1	01/17/89	/ /
White Deer,City of	3	3	07/12/88	12/01/88
Wilmer,City of	2	2	07/11/90	/ /
*** Total ***				
	1059	444		

PA-SCORE

REFERENCE 14

750 North St. Paul, Suite 700
Dallas, Texas
75201-3222

214/979-3900
Fax 214/979-3939

ICF TECHNOLOGY INCORPORATED

MEMORANDUM

TO: FILE

FROM: Kevin Jaynes

DATE: February 6, 1992

SUBJ: Summary of On-Site Reconnaissance Inspection. February 4, 1992. Metal Coatings Corporation, Houston, Texas (TXD072181969).

The ICF KE team conducted a tour of the Metal Coatings Corporation (MCC) facility on February 4, 1992. The ICF KE team met with the plant owner Mike Rountree who supplied requested information and conducted the tour of the facility.

ICF KE team leader Kevin Jaynes interviewed Mr. Rountree. The summary of the interview is as follows:

MCCs current status sheet on file with the Texas Water Commission (TWC) dated 5-16-90 was reviewed. Mr. Rountree indicated that all the information is up to date except that the use of filter cartridges had been discontinued several years ago. These cartridges were used to filter the caustic bath solutions for particles 10 to 15 microns in size.

Mr. Rountree indicated that there are currently 26 employees that work in two shifts, on-call 24 hours a day. Operations began at MCC in 1974.

ICF KE personnel then asked Mr. Rountree to explain the contaminated soil situation. Mr. Rountree explained that the soil had to be removed because of high concentrations of cyanide. The soil was classified as F006 wastes. The contaminated soil was excavated and stored in drums. The amount stored in the facility was approximately 4 to 6 cubic yards. Mr. Rountree then explained the process that he undertook to find an acceptor of these wastes. Mr. Rountree contracted Chemical Waste Management, Inc., Carlyss, Louisiana to begin the removal in November 1990. Mr. Rountree then provided the ICF KE team with manifests on previous removals. Chemical Waste Management, Inc. ran profiles on the wastes to be accepted and collected three of the five roll out containers of F006 sludges that had been mixed with the 4 to 6 yards of contaminated soil. The remaining two roll-out containers of waste were considered to have concentrations of cyanide too high to except. Mr. Rountree then contracted Horsehead Resource Development Company, Inc., Rockwood, Tennessee to remove the remaining amount of accumulated F006 sludge wastes and the remaining cadmium contaminated soil in December 1991.

ICF KE personnel questioned Mr. Rountree of the current plant operations and processes involved at MCC. Mr. Rountree indicated that currently Escandell

Associates, Inc. supplies a portable filter press for the de-watering of F006 sludges that are accumulated in the evaporator tank. The filter press is a portable press mounted on a tractor trailer. Horsehead Resources will dispose of the filter cake that is accumulated.

Mr. Rountree indicated that the roll-out containers varied in size but had capacity for 15 to 25 cubic yards of material.

Mr. Rountree indicated that the process of removing the contaminated soil and the continued problem of removing the F006 sludges took approximately three years. Mr. Rountree stated that Escandell Associates, Inc. will continue to provide the filter press service until MCC can purchase one of their own.

Future waste minimization plans include the reduction of hazardous waste disposal to 2 or 3 manifests a year and eventual classification of the wastes to allow for disposal in a Type II landfill.

Mr. Rountree explained the current plant process from a diagram dated 7-26-88. Mr Rountree corrected the diagram indicating that the feed sumps are now dry, the Chromium reduction and the treatment holding tank are no longer in use but are now stored at the facility. MCC does not discharge any wastewaters into the city sewer system.

Mr. Rountree indicated that cadmium plating no longer occurs at the site and was discontinued in 1988. Some zinc plating with additional phosphate salts still is done on-site.

ICF KE personnel questioned Mr. Rountree as to the status of the previously permitted storage tanks that were at one time located behind the building. Mr. Rountree indicated that one of the tanks had been cut up and sold for scrap and the second had been moved inside and now serves as a runoff collection basin for the sumps and containment units in the plating area.

Mr. Rountree stated that currently MCC operates under TWC generator permit No. 31596.

ICF KE personnel asked Mr. Rountree as to the reason for the soil contamination that was reported. Mr. Rountree indicated that the contamination was from a ruptured tank in the plating line in 1984, before containment structures had been implemented. The area of contaminated soil was excavated until testing by the city considered it adequate.

Current processes involve the preparation and coating of nuts and bolts for a Teflon coating. This coating goes by the registered trade name Fluorocoat. The application is sprayed on and then baked. Current spraying operations involve the use of four overspray booths. These booths incorporate metal baffles to collect the overspray. These baffles are periodically baked in the process ovens and the dried paint is collected as an industrial waste and can be disposed in a Type II landfill. Mr. Rountree indicated that future product and waste minimization plans include the implementation of an Electrostatic Reciprocating Disc for the application of the Teflon coatings.

ICF KE personnel and Mr. Rountree began the tour of the facility. In building Area 1 the following items and topics were discussed:

Area 1 is a shipping and receiving area which holds an overspray booth and a curing oven. Some product storage is here which include 55-gallon drums of acetone, MEK and isopropyl alcohol.

Area 2 houses the remaining three overspray booths. This area also houses a 2,000 gallon phosphating solution tank. The phosphate solution is heated to 160 degrees Fahrenheit to develop phosphate crystals on parts to be coated. There is also an 800 gallon caustic soap cleaning tank adjacent to the phosphate solution tank.

ICF KE personnel toured the area where the 2,000 gallon evaporator tank is housed. The tank is housed in an open area in back of the facility and has no engineered containment structures.

Area 3 houses the electroplating lines. Mr. Rountree explained the plating process which involves consecutive washes and emulsions in water, sulfuric acid, hydrochloric acid, cyanide baths and phosphate salt solutions. The plating line area is bermed with a six inch concrete berm additionally the cyanide tank area is separately bermed. The integrity of the berm was poor with evidence of breached integrity and attempts to patch the cracked concrete portions. Rinse waters from the tanks are removed approximately once a week by a diaphragm pump into holding tanks and eventually introduced into the evaporator tank. This area also houses the old cadmium plating line that is no longer used. These tanks are sometimes used as holding tanks for the rinse waters if the evaporator tank is full.

Area 4 houses a grit blast booth and a shed within a shed that is used to store miscellaneous trash and the remaining barrels from the soil contamination collection. The drums remain in this area which have not been triple rinsed as yet, additional soil from regular clean up of the area and dry paint flakes for future disposal.

ICF KE personnel noted upon exiting the site that the nearest residence is less than 20 feet west of the facility. Additionally, site sketches were developed and surface water runoff from the facility was noted.

PA-SCORE

REFERENCE 15

U.S. DEPARTMENT OF COMMERCE
Luther H. Hodges, Secretary

WEATHER BUREAU
F. W. Reichelderfer, Chief

TECHNICAL PAPER NO. 40

RAINFALL FREQUENCY ATLAS OF THE UNITED STATES

for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years

Prepared by
DAVID M. HERSHFIELD
Cooperative Studies Section, Hydrologic Services Division
for
Engineering Division, Soil Conservation Service
U.S. Department of Agriculture

THIS ATLAS IS OBSOLETE FOR THE FOLLOWING 11 WESTERN STATES: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

NOAA ATLAS 2: PRECIPITATION-FREQUENCY ATLAS OF THE WESTERN UNITED STATES (GPO: 11 Vols., 1973) supersedes the Technical Paper 40 data for these states.

All but 3 of the 11 state volumes are out of print, and no reprint is presently planned.

Institutions in the eleven western states likely to have copies of these volumes for their state for public inspection are:

US Department of Agriculture Soil Conservation Service Offices
US Army Corps of Engineers Offices
Selected University Libraries
National Weather Service Offices (may also have volumes for adjacent states).
National Weather Service Forecast Offices (may have all eleven volumes)

Elsewhere, libraries of universities where hydrology and meteorology degree programs are offered may shelve some of the eleven volumes.

The three volumes in print as of 1 Jan 1983 at the GPO are:

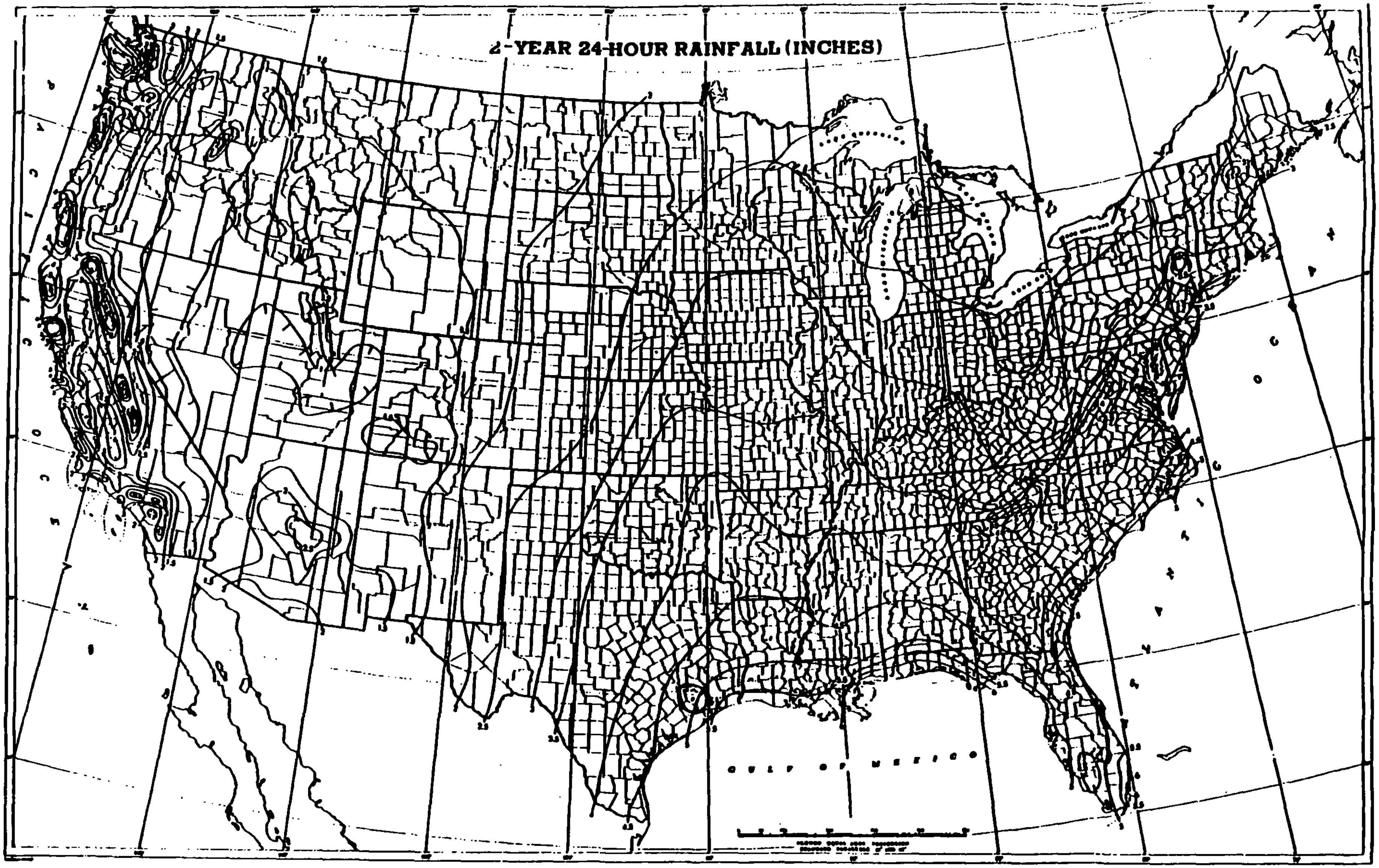
Vol	State	GPO Stock Number	Price
IV	New Mexico	003-017-00156-0	$10.00
VI	Utah	003-017-00160-1	12.00
VII	Nevada	003-017-0016?-0	9.50

The GPO order number is 202-783-3238 for VISA and MASTERCARD orders which

NOTICE
Rainfall-frequency information for durations of 1 hour and less for the Central and Eastern States has been superseded by NOAA Technical Memorandum NWS HYDRO-35 Five to Sixty-Minute Precipitation Frequency for the Eastern and Central United States. This publication (Accession No. PB 272-112/AS) is obtainable from:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

WASHINGTON, D.C.
May 1961


2-YEAR 24-HOUR RAINFALL (INCHES)
GULF OF MEXICO

PA-SCORE

REFERENCE 16

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

HARRIS COUNTY, TEXAS AND INCORPORATED AREAS

PANEL 275 OF 390

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
HOUSTON, CITY OF	480296	0275	G
HUNTERS CREEK VILLAGE, CITY OF	480298	0275	G
PINEY POINT VILLAGE, CITY OF	480308	0275	G

MAP NUMBER

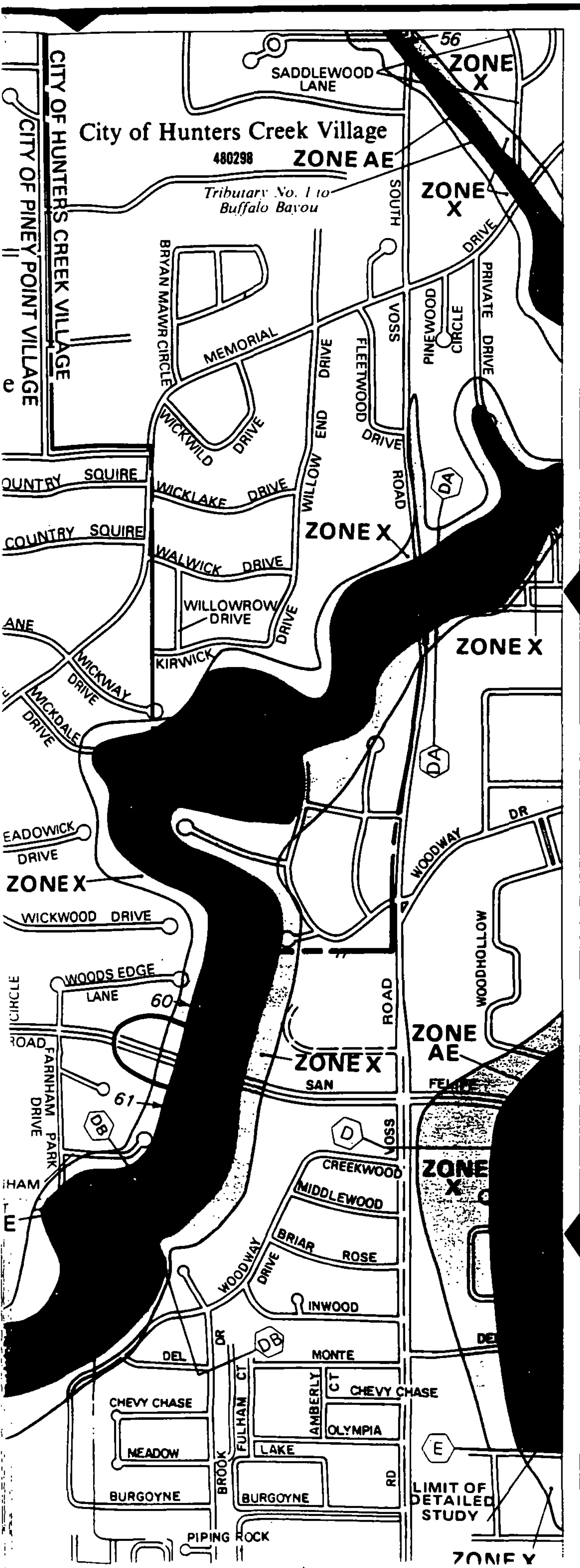
48201C0275 G

EFFECTIVE DATE:
SEPTEMBER 28, 1990

FEDERAL EMERGENCY MANAGEMENT AGENCY

Federal Emergency Management Agency

J



LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

ZONE A	No base flood elevations determined.
ZONE AE	Base flood elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding; velocities also determined.
ZONE A99	To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.
ZONE V	Coastal flood with velocity hazard (wave action); no base flood elevations determined.
ZONE VE	Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X	Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

ZONE X	Areas determined to be outside 500-year floodplain.
ZONE D	Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Floodplain Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet*

D — D Cross Section Line

(EL 987) Base Flood Elevation in Feet Where Uniform Within Zone*

RM7 X Elevation Reference Mark

•M1.5 River Mile

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas. The community map repository should be consulted for possible updated flood hazard information prior to use of this map for property purchase or construction purposes.

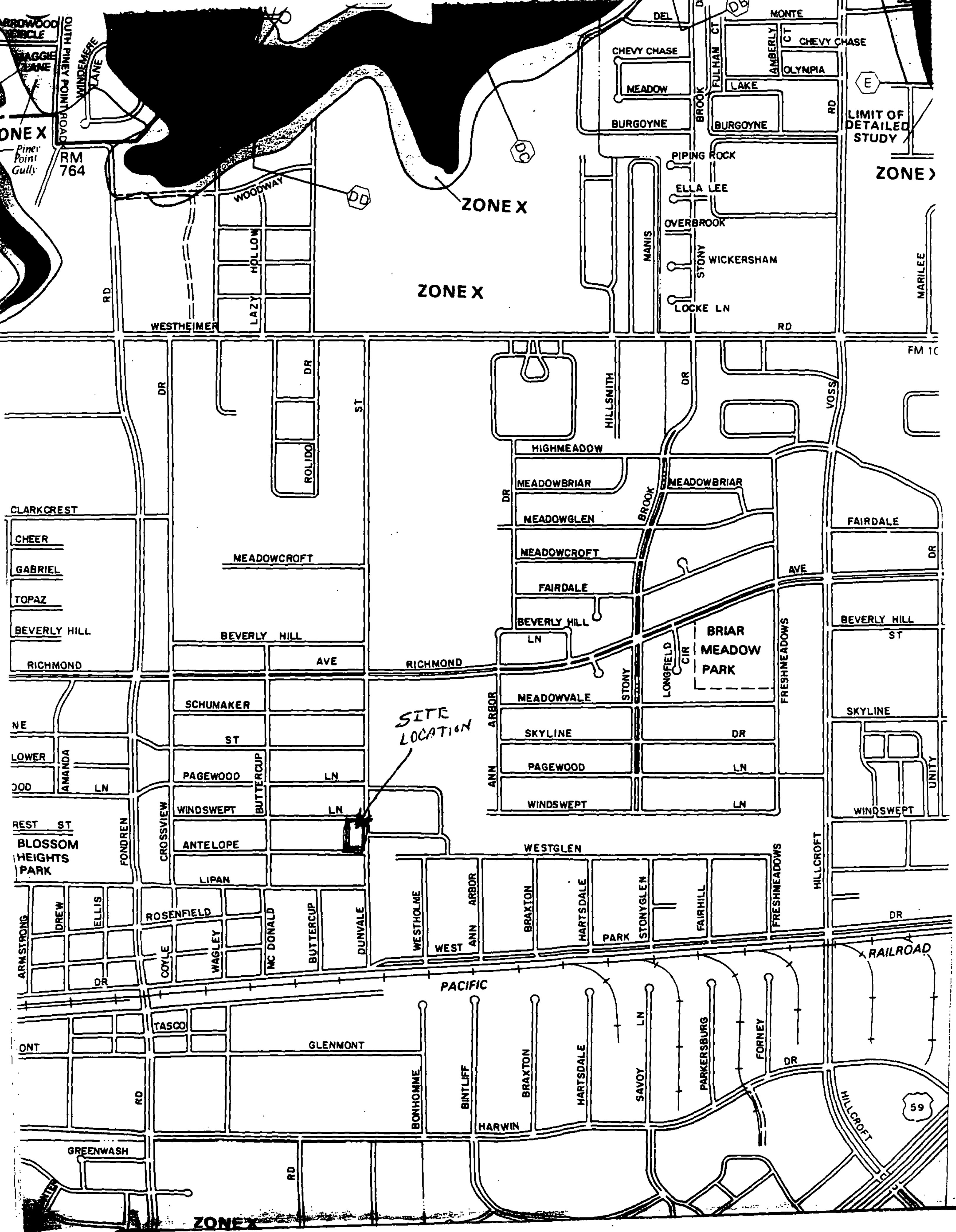
Coastal base flood elevations apply only landward of 0.0 NGVD, and include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

Areas of special flood hazard (100-year flood) include Zones A, AE, AH, AO, A99, V, and VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the [illegible]



ZONE X
Piney Point Gully
RM 764
SOUTH PINEY POINT ROAD
WINDEMERE LANE
MAGGIE LANE
WOODWAY
DD
DC
DEL MONTE
CHEVY CHASE
MEADOW
BURGOYNE
BROOK
FULHAM CT
AMBERLY CT
OLYMPIA
LAKE
E
LIMIT OF DETAILED STUDY
PIPING ROCK
ELLA LEE
OVERBROOK
WICKERSHAM
STONY
MANIS
LOCKE LN
LAZY HOLLOW
WESTHEIMER
RD
MARILEE
FM 10
HILLSMITH
VOSS
ROLIDO
DR
ST
HIGHMEADOW
MEADOWBRIAR
MEADOWGLEN
MEADOWCROFT
FAIRDALE
BEVERLY HILL
AVE
BRIAR MEADOW PARK
LONGFIELD CIR
FRESHMEADOWS
CLARKCREST
CHEER
GABRIEL
TOPAZ
RICHMOND
SCHUMAKER
SKYLINE
PAGEWOOD
WINDSWEPT
ANN ARBOR
MEADOWVALE
UNITY
AMANDA
LN
BUTTERCUP
CROSSVIEW
FONDREN
ANTELOPE
LIPAN
WESTGLEN
BLOSSOM HEIGHTS PARK
SITE LOCATION
ROSENFIELD
ARMSTRONG
DREW
ELLIS
COYLE
WAGLEY
MC DONALD
DUNVALE
WESTHOLME
WEST
BRAXTON
HARTSDALE
STONYGLEN
FAIRHILL
PARK
HILLCROFT
RAILROAD
PACIFIC
TASCO
GLENMONT
BONHOMME
BINTLIFF
SAVOY
PARKERSBURG
FORNEY
HARWIN
GREENWASH
59

PA-SCORE

REFERENCE 17

TEXAS * WATER * COMMISSION
8900 Shoal Creek Blvd., Bldg. 200, Austin, Tx. 78758
Telefax #: (512) 371-6202

FAX COVER LETTER

DATE: 7-9-91

TO:

Company: ICS TECHNOLOGY
Name: KIM BIRDSALL
City: DALLAS State: TEXAS
Fax #: 214 747 1826

FROM:

Company: TEXAS WATER COMMISSION
Name: ARLETTE CAPEHART
Phone No.: 512--371-6390

COMMENTS:

Total Number of Pages Being Sent Including This Cover Sheet 5

For Verification of Telecommunications Transmission.
Please Contact the Operator at (512) 371-6201

STATUS
NUMBER
TYPE
BASIN
COUNTY
RIVER ORDER NO.
PERMIT NO.
OWNER(S)
STREAM
TYPE OF USE
AMOUNT OF WATER
NUMBER OF ACRES
PRIORITY DATE
RESERVOIR CAPACITY
DATE ISSUED
TERM STATUS

TYPE OF WATER USES

1. MUNICIPAL/DOMESTIC
2. INDUSTRIAL
3. IRRIGATION
4. MINING
5. HYDROELECTRIC
6. NAVIGATION
7. RECREATION
8. FLOOD CONTROL
9. RECHARGE

TYPE OF WATER RIGHTS

1 - APPLICATION/PERMIT
2 - CLAIM
3 - CERTIFIED FILING
5 - DISMISSED/REJECTED
6 - CERTIFICATION OF ADJUDICATION
9 - CONTRACTUAL PERMIT/AGREEMENT

STATUS OF WATER RIGHTS

A - ADJUDICATED
P - PARTIALLY CANCELLED
R - DISMISSED/REJECTED
T - TOTALLY CANCELLED

TERM STATUS

A - SPECIFIC DATE
B - NO SPECIFIC DATE
C - PERMIT TO BE REDUCED IF AWARDED A RIGHT UNDER CLAIM
D - NOT AUTHORIZED TO USE UNTIL AMENDED

BASIN CODES

1. CANADIAN
2. RED
3. SULPHUR
4. CYPRESS
5. SABINE
6. NECHES
7. NECHES-TRINITY
8. TRINITY
9. TRINITY-SAN JACINTO
10. SAN JACINTO
11. SAN JACINTO-BRAZOS
12. BRAZOS
13. BRAZOS-COLORADO
14. COLORADO
15. COLORADO-LAVACA
16. LAVACA
17. LAVACA-GUADALUPE
18. GUADALUPE
19. SAN ANTONIO
20. SAN ANTONIO-NUECES
21. NUECES
22. NUECES-RIO GRANDE
23. RIO GRANDE

COUNTY CODE LIST

1-Anderson
2-Andrews
3-Angelina
4-Aransas
5-Archer
6-Armstrong
7-Atascosa
8-Austin
9-Bailey
10-Bandera
11-Bastrop
12-Baylor
13-Bee
14-Bell
15-Bexar
16-Blanco
17-Borden
18-Bosque
19-Bowie
20-Brazoria
21-Brazos
22-Brewster
23-Briscoe
24-Brooks
25-Brown
26-Burleson
27-Burnet
28-Caldwell
29-Calhoun
30-Callahan
31-Cameron
32-Camp
33-Carson
34-Cass
35-Castro
36-Chambers
37-Cherokee
38-Childress
39-Clay
40-Cochran
41-Coke
42-Coleman
43-Collin
44-Collingsworth
45-Colorado
46-Comal
47-Comanche
48-Concho
49-Cooke
50-Coryell
51-Cottle
52-Crane
53-Crockett
54-Crosby
55-Culberson
56-Dallam
57-Dallas
58-Dawson
59-Deaf Smith
60-Delta
61-Denton
62-DeWitt
63-Dickens
64-Dimmit
65-Donley
66-Duval
67-Eastland
68-Ector
69-Edwards
70-Ellis
71-El Paso
72-Erath
73-Falls
74-Fannin
75-Fayette
76-Fisher
77-Floyd
78-Foard
79-Fort Bend
80-Franklin
81-Freestone
82-Frio
83-Gaines
84-Galveston
85-Garza
86-Gillespie
87-Glasscock
88-Goliad
89-Gonzales
90-Gray
91-Grayson
92-Gregg
93-Grimes
94-Guadalupe
95-Hale
96-Hall
97-Hamilton
98-Hansford
99-Hardeman
100-Hardin
101-Harris
102-Harrison
103-Hartley
104-Haskell
105-Hays
106-Hemphill
107-Henderson
108-Hidalgo
109-Hill
110-Hockley
111-Hood
112-Hopkins
113-Houston
114-Howard
115-Hudspeth
116-Hunt
117-Hutchinson
118-Irion
119-Jack
120-Jackson
121-Jasper
122-Jeff Davis
123-Jefferson
124-Jim Hogg
125-Jim Wells
126-Johnson
127-Jones
128-Karnes
129-Kaufman
130-Kendall
131-Kenedy
132-Kent
133-Kerr
134-Kimble
135-King
136-Kinney
137-Kleberg
138-Knox
139-Lamar
140-Lamb
141-Lampasas
142-La Salle
143-Lavaca
144-Lee
145-Leon
146-Liberty
147-Limestone
148-Lipscomb
149-Live Oak
150-Llano
151-Loving
152-Lubbock
153-Lynn
154-McCulloch
155-McLennan
156-McMullen
157-Madison
158-Marion
159-Martin
160-Mason
161-Matagorda
162-Maverick
163-Medina
164-Menard
165-Midland
166-Milam
167-Mills
168-Mitchell
169-Montague
170-Montgomery
171-Moore
172-Morris
173-Motley
174-Nacogdoches
175-Navarro
176-Newton
177-Nolan
178-Nueces
179-Ochiltree
180-Oldham
181-Orange
182-Palo Pinto
183-Panola
184-Parker
185-Parmer
186-Pecos
187-Polk
188-Potter
189-Presidio
190-Rains
191-Randall
192-Reagan
193-Real
194-Red River
195-Reeves
196-Refugio
197-Roberts
198-Robertson
199-Rockwall
200-Runnels
201-Rusk
202-Sabine
203-San Augustine
204-San Jacinto
205-San Patricio
206-San Saba
207-Schleicher
208-Scurry
209-Shackelford
210-Shelby
211-Sherman
212-Smith
213-Somervell
214-Starr
215-Stephens
216-Sterling
217-Stonewall
218-Sutton
219-Swisher
220-Tarrant
221-Taylor
222-Terrell
223-Terry
224-Throckmorton
225-Titus
226-Tom Green
227-Travis
228-Trinity
229-Tyler
230-Upshur
231-Upton
232-Uvalde
233-Val Verde
234-Van Zandt
235-Victoria
236-Walker
237-Waller
238-Ward
239-Washington
240-Webb
241-Wharton
242-Wheeler
243-Wichita
244-Wilbarger
245-Willacy
246-Williamson
247-Wilson
248-Winkler
249-Wise
250-Wood
251-Yoakum
252-Young
253-Zapata
254-Zavala

STATUS	EDITPR No.	TYPE	BASIN	COUNTY	RIVER ORDER No.	PERMIT No.	OWNER	STREAM	TYPE OF USE	AMOUNT OF WATER	No. OF ACRES	PRIORITY DATE	RESERVOIR CAPACITY	DATE ISSUED
A	003000	1	10	101	1200000000	002731	GENERAL PORTLAND INC	BUFFALO BAYOU	2	1615		19720327		19720517
T	002388	1	10	101	1275000000	002162	HOUSTON L&P CO-GABLE	BUFFALO	2	103527	625	19650407		19650615
	005209	1	10	101	1300000000	005209	INWOOD FOREST GOLF CLUB LTD	WHITE OAK BAYO	3	230	98	19881215	16	19890406
T	000390	3	10	101	1400000000		GLENWOOD CEMETARY ASSN	BUFFALO	3	0000000030	0000020	19140623		19140630
A	003072	1	10	101	1400700000	002790	THE MUSEUM OF FINE ARTS	BUFFALO BAYOU	3	19	8	19720911		19721101
	003988	6	10	101	1400700000		MUSEUM OF FINE ARTS	BUFFALO BAYOU	3	19	8	19720911		19860314
A	003850	1	10	101	1400800000	003556	RIVER OAKS COUNTRY CLUB	BUFFALO BAYOU	3	460	129	19780130	75	19780412
	003985	6	10	101	1400800000		RIVER OAKS COUNTRY CLUB	BUFFALO	3	460	129	19780130	75	19860314
	005336	1	10	101	1800000000	005336	HOUSTON COUNTRY CLUB	BUFFALO BAYOU	3	175	118	19901205	20	19910319
A	003275	2	10	101	1980000000		JOSEPH W TAYLOR ET AL	BUFFALO BAYOU	3	6	6	19690829		19700220
T	000923	1	10	101	2000000000	000879	J A RUSH	BUFFALO	3	0000000080	0000040	19250516	0004	19260818
	005257	1	10	101	2500000000	005257	LAKESIDE COUNTRY CLUB	BUFFALO BAYOU	3	175	70	19890913	75	19900529
T	000162	3	10	101	2600000000		A STOCKDICK ESTATE	SO MAYDE	3	0000000000	0000000	19140507		19140613
A	003350	2	10	101	2620000000		LENOIR M JOSEY INC	LANGHAM	3	50	200	19690830		19700227
	003984	6	10	101	2620000000		LENOIR M. JOSEY, INC.	LANGHAM	3	26	56	19630630		19860314
	005332	1	10	101	2623000000	005332	PINE FOREST COUNTRY CLUB	BEAR CRK	3	378	150	19901128	35	19910319
	004066 A	1	10	101	2625000000	003779A	MARIAN W FLEMING	BEAR CR	3	45	25	19800811	9	19801209
A	002031	2	10	101	2630000000		HAROLD FREEMAN	BEAR CR	3	800	0000400	19690826	0150	19691114
	003983	6	10	101	2630000000		HAROLD & JESSE FREEMAN	BEAR	3	800	408	19161231	150	19860314
A	001251	2	10	079	2800000000		JAMIE A ROBINSON ET AL	BUFFALO B	3	0000000200	0000100	19690825		19690930
	003982	6	10	079	2800000000		CINCO RANCH VENTURE	BUFFALO	3	45	29	19520630		19860314
A	001252	2	10	101	2810000000		JAMIE A ROBINSON ET AL	BUFFALO B	3	0000000100	0000100	19690825		19690930
A	001253	2	10	101	2820000000		JAMIE A ROBINSON ET AL	BUFFALO BAYOU	3	0000000100	0000050	19690825		19690930
T	000013	3	10	101	3000000000		SAN JACINTO RICE CO	S JACINTO	3	0000021000	0014000	19131216		19131229
T	001519	1	10	101	3400000000	001414	TEXAS BUTADIENE-CHEM	S JACINTO	3	0000000640	0000320	19470521		19470719
R	000514 R	4	10	101	3600000000	0000000	SIEBER AND FLEMING	S JACINTO	3			19200915		
	005334	1	10	101	3640000000	005334	COOPER'S MARINE SER, INC	OLD RIVER CH	2			19901127		19910319

PA-SCORE

REFERENCE 18

TEXAS
PARKS AND WILDLIFE DEPARTMENT

4200 Smith School Road • Austin, Texas 78744 • 512-389-4800

July 9, 1991

Kim Birdsall
1509 Main Street
Dallas, TX 75201
(214) 744-1641

Mark A. Webb
Inland Fisheries District Office
1004 East 26th Street
Bryan, TX 77803
(409) 822-5067

Dear Kim,

In answer to your inquiry about the fishery of Buffalo Bayou the enclosed draft of a report is all I have in my files. I'll keep looking for a completed report or additional information. If you have questions please call.

Sincerely,

Mark A. Webb

Mark A. Webb
District Management Supervisor

Report of Fish Sampling, Buffalo Bayou

To gather some information on the fish community in the western end of Buffalo Bayou, Harris County, Texas, fish collections were made with an electrofishing unit and a 20-ft. common sense minnow seine on August 3, 1978.

Description of Bayou

Buffalo Bayou, approximately one mile upstream from Wilcrest Drive bridge, ranges from 20 to 80 feet wide. The depth of the water varies from 6 inches to 3½ feet. The bayou has two riffle areas, about 50 feet in length; the substrate is primarily rock and gravel in the middle and silt deposits along the shoreline.

At the Wilcrest Drive bridge the bayou narrows to approximately 15 feet; the water was approximately 2 feet deep. Below the bridge, downstream, the bayou ranges from 30 to 90 feet in width. The water depth ranges from 1½ to approximately 6 feet.

At the time of the sampling, the water level was normal and the turbidity was an estimated 2 inches. In general the banks are gently sloping; in some places they are sharply cut. Along most of the bayou the banks are heavily covered with Chinaberry, willow and cottonwood trees. Debris of all kinds is common along the bayou.

Aquatic vegetation consists of alligator weed, water pennywort, duck potato and spikerush.

Fish Collections

One 5-minute and two 20-minute electrofishing collections were made. In addition, one seining collection was made.

Collection 1. Results of electrofishing, 20-minute sample, Buffalo Bayou, 1 mile upstream from Wilcrest Drive bridge, August 3, 1978.

Species	Number	Estimated Weight (lbs.)
Spotted gar	1	1
Longnose gar	1	1

Gizzard shad	2	¼
Smallmouth buffalo	6	2-5
Channel catfish	2	¼
Flathead catfish	4	¼-20

Collection 2. Results of electrofishing, 20-minute sample, Buffalo Bayou, 1 mile downstream from Wilcrest Drive bridge, August 3, 1978.

Species	Number	Estimated Weight (lbs.)
Spotted gar	16	½-3
Smallmouth buffalo	4	5-12
Flathead catfish	1	10

Collection 3. Results of electrofishing, 5-minute sample, Buffalo Bayou, 300 ft. downstream from Collection 2, August 3, 1978.

Species	Number	Estimated Weight (lbs.)
Alligator gar	1	50
Spotted gar	2	1
Smallmouth buffalo	2	3-5

Collection 4. Results of seining, 2 40-foot drags, Buffalo Bayou, near Wilcrest Drive bridge, August 3, 1978.

Species	Number	Total Length (inches)
Mosquitofish	274	1
Mosquitofish	3	2

Several large, in excess of 50 pounds each, alligator gar were observed; however, they were too large to pick up with our dip nets. In addition, two redear turtles were observed.

All fish were returned to the bayou. Most of them were alive except the shad and some of the gar.

Discussion

The western end of Buffalo Bayou is an interesting stream. The first impression ~~one~~ a person is likely to get is that this is just a turbid, litter-filled stream with few, if any, desirable fish. TP In its riparian state, there is limited access to the bayou due to the luxuriant growth of trees along the banks. Anglers who wish to fish are limited primarily to the road crossings. There was little evidence of any sport fishing activity along the section of the bayou we worked. No anglers were seen. Boat traffic is impeded by fallen trees. The depth of the water ranged from 6 inches to 6 feet; the average depth was less than 3 feet.

However, eight species of fish were collected. Four species could be classified as predators, alligator, spotted and longnose gar, and flathead catfish. The alligator gar and the flathead catfish were the most impressive fish found in Buffalo Bayou. The small channel catfish and flathead catfish indicate successful natural reproduction. Probably the most important forage species found was the gizzard shad.

Conclusions

Additional fish collections should be made below Barker Dam as soon as possible. Messrs. Max Bargsley and Jim Mladenka of the Corps of Engineers office at Barker Dam reported that anglers frequently catch largemouth bass, crappie, bream and blue catfish below the dam.

No photographs were taken; however, photographs should be taken on the next field trip to record the conditions of the bayou and the size of the fish collected.

The field work was done by Johnny Melcer, Ray Vrana and

Charlie Menn of the Texas Parks and Wildlife Department.

Prepared by: ____________________
C. T. Menn

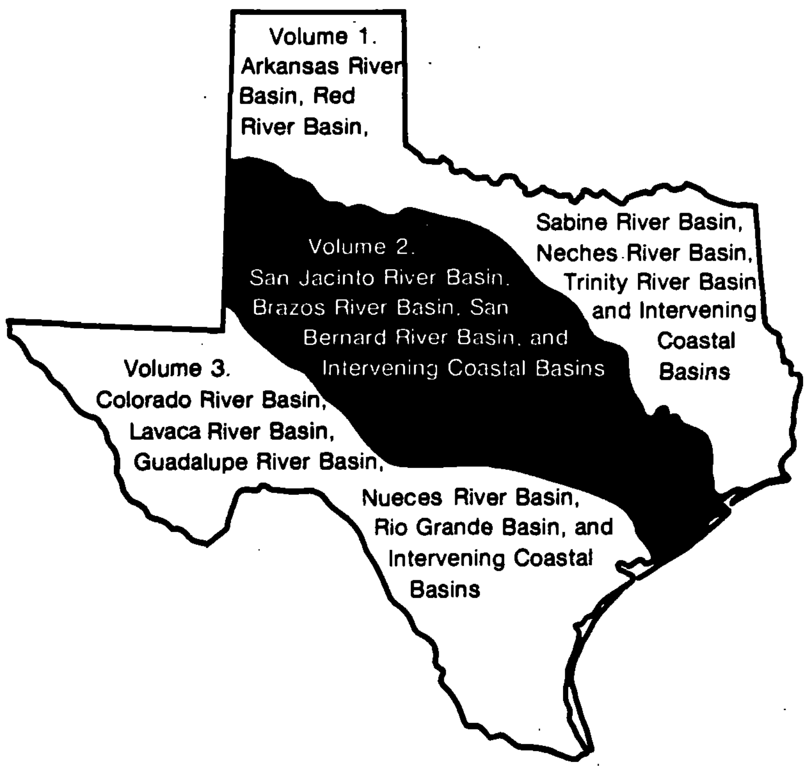
Date: August 9, 1978

PA-SCORE

REFERENCE 19

Water Resources Data Texas Water Year 1987

Volume 2. San Jacinto River Basin, Brazos River Basin, San Bernard River Basin, and Intervening Coastal Basins



U.S. GEOLOGICAL SURVEY WATER-DATA REPORT TX-87-2
Prepared in cooperation with the State of Texas
and with other agencies

CONTENTS

ILLUSTRATION

08074000 BUFFALO BAYOU AT HOUSTON, TX

LOCATION.--Lat 29°45'36", long 95°24'30", Harris County, Hydrologic Unit 12040104, on right bank at downstream side of bridge on Shepherd Drive in Houston and 0.8 mi upstream from Waugh Drive.

DRAINAGE AREA.--358 mi², unadjusted for basin boundary changes.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--May 1936 to September 1957, October 1957 to December 1961 (high-water records and discharge measurements), January 1962 to September 1975, October 1975 to current year (high-water records and discharge measurements).

REVISED RECORDS.--WSP 1732: Drainage area (former site).

GAGE.--Water-stage recorder and crest-stage gages. Datum of gage is 1.36 ft below National Geodetic Vertical Datum of 1929, 1973 adjustment; records unadjusted for land-surface subsidence. Prior to June 19, 1936, nonrecording gage, and June 19, 1936 to Jan. 16, 1962, water-stage recorder at site 0.8 mi downstream at 4.08-foot lower datum. Jan. 17, 1962 to Sept. 30, 1973, auxiliary water-stage recorder 0.8 mi downstream. Water-stage recorder at Main Street (station 08074600) used as auxiliary gage after Sept. 30, 1973.

REMARKS.--No estimated daily discharges. Records fair. Although floodflows are regulated by Barker and Addicks Reservoirs (stations 08072500 and 08073000) located 26.3 and 26.8 mi upstream, respectively, flood peaks from the urbanized areas below these reservoirs are often independent of the regulation. Discharge is computed using a stage-fall-discharge relationship for all storms that produce peak discharges above 1,500 ft³/s. Discharges below 1,000 ft³/s are computed or estimated following designated storm periods only. Low flow is mostly sustained by sewage effluent from Houston suburbs. Gage heights are affected by tides, backwater from Whiteoak Bayou, and other streams. Gage-height telemeter at station.

AVERAGE DISCHARGE.--8 years (water years 1936-44) unregulated, 272 ft³/s, 197,100 acre-ft/yr; 26 years (water years 1944-57, 1962-75) regulated, 274 ft³/s, 198,500 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 10,900 ft³/s Aug. 30, 1945 (gage height, 28.82 ft), at site 0.8 mi downstream at present datum; minimum daily, 1.3 ft³/s May 24, 1939, Nov. 5, 1950, occurred prior to urban development and accompanying sewage effluent releases.

EXTREMES OUTSIDE PERIOD OF RECORD.--All flood data at site 0.8 mi downstream at present datum. Maximum gage height since at least 1835, 49.0 ft Dec. 9, 1935 (discharge, 40,000 ft³/s); furnished by engineer for Harris County. Flood of May 31, 1929, reached a gage height of 43.5 ft (discharge, 19,000 ft³/s), at bridge on Capitol Avenue, affected by bridge; furnished by city of Houston.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,270 ft³/s July 9 at 1100 hours (gage height, 19.71 ft); minimum discharge not determined (affected by tides).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1986 TO SEPTEMBER 1987
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	---	---	---	1090	---	---	---	810	---	---
2	---	---	---	---	---	1240	---	---	---	1270	---	---
3	---	---	---	---	---	1390	---	---	---	523	---	---
4	---	1010	---	---	---	1280	---	---	---	---	---	---
5	---	940	---	---	---	1380	---	---	---	---	---	---
6	---	---	---	---	---	1360	---	---	---	---	---	---
7	---	---	---	---	---	730	---	---	---	---	---	---
8	---	---	---	---	---	---	---	---	---	---	---	---
9	---	---	---	---	---	---	---	---	1580	2740	---	---
10	---	---	---	---	---	---	---	---	1640	462	---	---
11	---	---	---	---	---	---	---	---	1620	---	---	---
12	1380	---	---	---	---	---	---	---	4000	---	---	---
13	1310	---	---	---	---	---	---	---	2310	---	---	---
14	530	---	150	---	---	---	---	---	538	---	---	---
15	---	---	2600	350	---	---	---	---	---	---	---	---
16	---	---	1070	1290	---	---	---	475	1080	---	---	---
17	---	---	850	1950	---	---	---	620	809	---	---	---
18	---	---	1440	710	---	---	---	---	1470	---	---	---
19	---	---	530	---	---	---	---	---	---	---	---	---
20	---	---	770	---	---	---	---	---	---	---	---	---
21	---	---	730	---	---	---	---	---	---	---	---	---
22	1070	---	2360	650	---	---	---	---	---	---	---	---
23	460	1390	3360	1360	---	---	---	---	---	---	---	---
24	---	2840	710	1540	---	---	---	---	---	---	---	---
25	---	1560	1080	1010	710	---	---	---	---	---	---	---
26	---	380	1070	---	3170	---	---	---	---	---	---	---
27	---	---	1000	---	680	---	---	---	---	---	---	---
28	---	---	940	---	420	---	---	---	---	---	---	---
29	---	---	---	---	---	---	---	524	---	---	---	---
30	---	---	---	---	---	---	---	489	1610	---	---	---
31	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL	---	---	---	---	---	---	---	---	---	---	---	---
MEAN	---	---	---	---	---	---	---	---	---	---	---	---
MAX	---	---	---	---	---	---	---	---	---	---	---	---
MIN	---	---	---	---	---	---	---	---	---	---	---	---
AC-FT	---	---	---	---	---	---	---	---	---	---	---	---

WTR YR 1987 TOTAL - MEAN - MAX - MIN - AC-FT

PA-SCORE

REFERENCE 20

LP 88-04

The State of Texas Water Quality Inventory

9th Edition 1988

Texas Water Commission

April 1988

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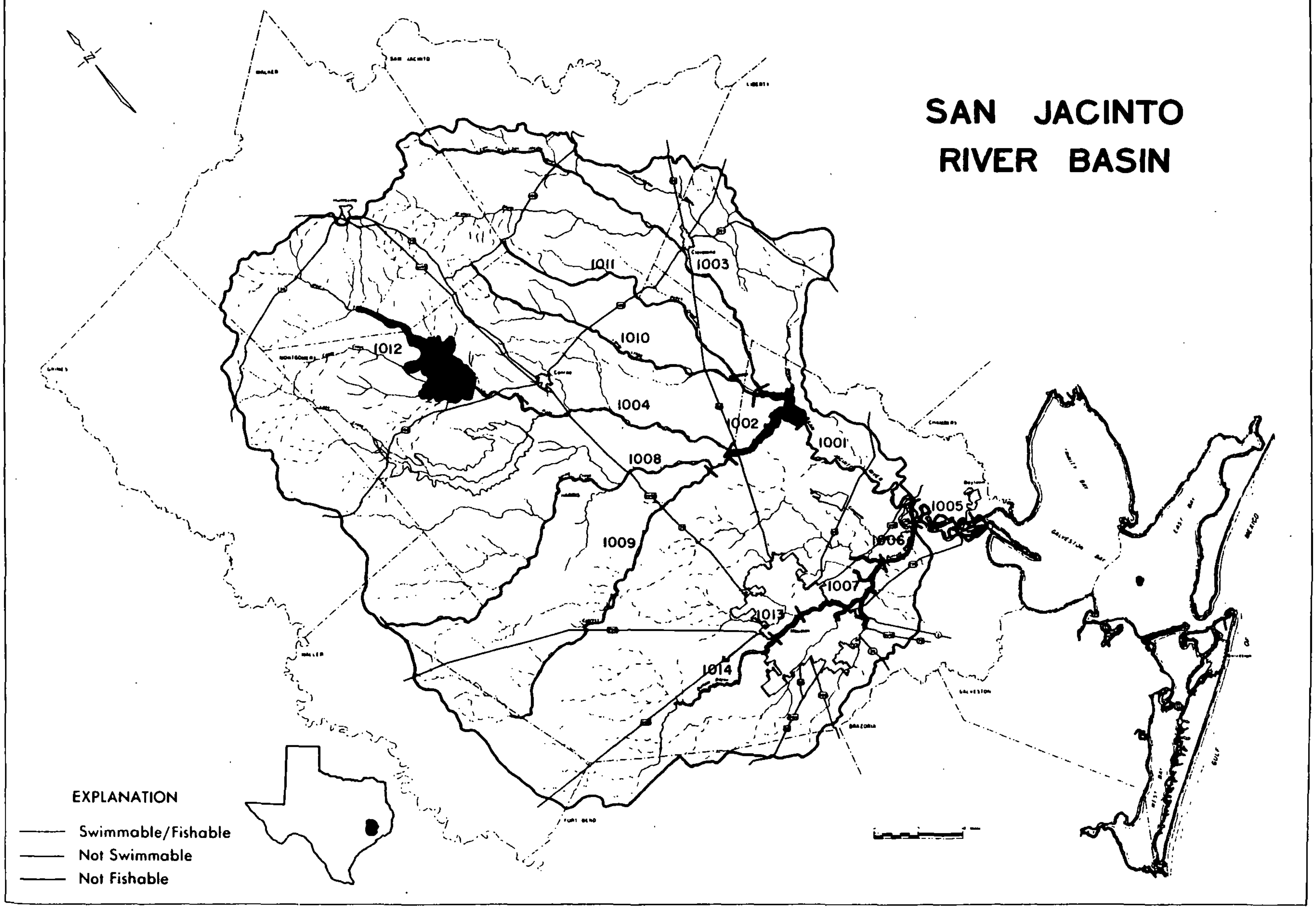
SAN JACINTO RIVER BASIN



Segment 1013 of the San Jacinto River Basin

NAME: Buffalo Bayou Tidal

DESCRIPTION: from a point 100 meters (110 yards) upstream of US 59 in Harris County to a point 100 meters (110 yards) downstream of Shepherd Drive in Harris County

SEGMENT CLASSIFICATION AND RANK: Water Quality Limited

LENGTH: 4 miles (7 kilometers)

DESIGNATED WATER USES: Noncontact Recreation

MONITORING STATIONS: 1013.2560, 1013.2600

INTENSIVE SURVEYS:

03 Aug 1982	Q,F,C,L	IS-86-10	(Kirkpatrick: Dec 1986)
09 Jul 1984	Q,F,C,L	IS-87-06	(Kirkpatrick: Apr 1987)
25 Feb 1985	Q,F,C,L	IS-87-09	(Kirkpatrick: Jul 1987)
15 Jul 1985	Q,X,F,C,B	IS-87-05	(Kirkpatrick: May 1987)
13 May 1986	Q,X,F,C,R	IS-87-05	(Kirkpatrick: May 1987)

PERMITTED FACILITIES (FINAL):

Domestic	69 outfalls	76.39 MGD	7393.2 lb/d BOD
Industrial	12 outfalls	0.20 MGD	6.3 lb/d BOD
Total	81 outfalls	76.59 MGD	7399.5 lb/d BOD

KNOWN WATER QUALITY PROBLEMS/WATER QUALITY STANDARD COMPARISON:

Fecal coliform concentrations persistently exceed 2000/100 mL, and dissolved oxygen levels are sometimes less than the 2.0 mg/L criterion. This segment does not meet fishable/swimmable criteria due to depressed dissolved oxygen levels and elevated fecal coliform levels (Table 4).

POTENTIAL WATER QUALITY PROBLEMS:

Total and orthophosphorus levels are persistently elevated, and inorganic nitrogen is frequently elevated.

RELATIVE SIGNIFICANCE OF POINT AND NONPOINT SOURCE POLLUTANTS:

Point and nonpoint source discharges significantly affect water quality in this segment.

CONTROL PROGRAMS:

A. Existing: As recommended in the Houston Ship Channel Waste Load Evaluation (July 1984), the following requirements and activities have been implemented or are presently underway:

- More stringent wastewater permit requirements are in effect
- Self-reporting requirements have been expanded
- Additional intensive surveys have been conducted
- Sediment studies have been conducted
- Reaeration studies have been conducted
- Further water quality evaluations have been made
- Segment boundaries and standards criteria have been changed
- Nonpoint source studies have been conducted
- Instream aeration studies are in progress.

B. Programs still to be implemented: A use attainability analysis is in progress. Continuing intensive surveys, waste load evaluations and modeling/engineering evaluations will be conducted for the Houston Ship Channel system. Pending completion of the existing control programs, further evaluations, such as nitrifier and dispersion studies, may need to be undertaken.

FACTORS NEEDING CLARIFICATION WITH RESPECT TO CAUSE/EFFECT RELATIONSHIPS:

To be determined after the existing control programs have been studied.

KNOWN RELATIONSHIPS TO OTHER ENVIRONMENTAL PROBLEMS:

Currently being evaluated.

WATER QUALITY STATUS:

The following table presents water quality data for Segment 1013 from October 1, 1983 through September 30, 1987. Total dissolved solids were estimated by multiplying specific conductance by a factor of 0.5.

Parameter	Criterion	Number of Samples	Minimum	Maximum	Mean	Number of Values Outside Criteria	Mean Values Outside Criteria
Dissolved Oxygen (mg/L)	2.0	49	0.6	9.5	4.0	4	1.2
Temperature (F)	92.0	49	48.2	84.6	77.3	0	0
pH	6.5-9.0	24	7.0	8.4	7.8	0	0
Chloride (mg/L)	N/A	23	8	153	60	0	0
Sulfate (mg/L)	N/A	24	5	38	20	0	0
TDS (mg/L)	N/A	39	98	561	299	0	0
Fecal Coliforms (#/100 mL)	2000	24	2400	220000	11791	24	11791

Segment 1014 of the San Jacinto River Basin

NAME: Buffalo Bayou Above Tidal

DESCRIPTION: from a point 100 meters (110 yards) downstream of Shepherd Drive in Harris County to SH 6 in Harris County

SEGMENT CLASSIFICATION: Water Quality Limited

LENGTH: 24 miles (38 kilometers)

DESIGNATED WATER USES: Noncontact Recreation
Limited Quality Aquatic Habitat

MONITORING STATIONS: 1014.2700, 1014.2850

INTENSIVE SURVEYS:

02 Sep 1980	Q,X,D,F,C	IS-28	(Kirkpatrick: Mar 1982)
07 Oct 1980	Q,X,D,R	IS-28	(Kirkpatrick: Mar 1982)
03 Aug 1982	Q,F,C,L	IS-86-10	(Kirkpatrick: Dec 1986)
09 Jul 1984	Q,F,C,L	IS-87-06	(Kirkpatrick: Apr 1987)
25 Feb 1985	Q,F,C,L	IS-87-09	(Kirkpatrick: Jul 1987)
15 Jul 1985	Q,X,D,F,C,B	IS-87-05	(Kirkpatrick: May 1987)
13 May 1986	Q,X,F,C,R	IS-87-05	(Kirkpatrick: May 1987)
07 Apr 1987	Q,X,F,C		(Kirkpatrick: in preparation) South Mayde Creek

PERMITTED FACILITIES (FINAL):

Domestic	127 outfalls	170.46 MGD	14103.8 lb/d BOD
Industrial	25 outfalls	1.09 MGD	78.3 lb/d BOD
Total	152 outfalls	171.55 MGD	14182.1 lb/d BOD

KNOWN WATER QUALITY PROBLEMS/WATER QUALITY STANDARD COMPARISON:

Dissolved oxygen levels less than the criterion have been recorded. Fecal coliform bacteria frequently exceed 2000/100 mL. A portion of this segment does not meet fishable criteria due to depressed dissolved oxygen levels. The entire segment does not meet swimmable criteria due to elevated levels of fecal coliform bacteria (Table 4).

POTENTIAL WATER QUALITY PROBLEMS:

Chloride levels are occasionally elevated, and sulfate levels are elevated on rare occasions. Total and orthophosphorus levels are persistently elevated, and inorganic nitrogen levels are regularly elevated.

RELATIVE SIGNIFICANCE OF POINT AND NONPOINT SOURCE POLLUTANTS:

Point and nonpoint source discharges significantly affect water quality in this segment.

CONTROL PROGRAMS:

A. Existing: As recommended in the Houston Ship Channel Waste Load Evaluation (July 1984), the following requirements and activities have been implemented or are presently underway:

- More stringent wastewater permit requirements are in effect
- Self-reporting requirements have been expanded
- Additional intensive surveys have been conducted
- Sediment studies have been conducted
- Reaeration studies have been conducted
- Further water quality evaluations have been made
- Segment boundaries and standards criteria have been changed
- Instream aeration studies are in progress.

B. Programs still to be implemented: A use attainability analysis is in progress. Continuing intensive surveys, waste load evaluations and modeling/engineering evaluations will be conducted for the Houston Ship Channel system. Pending completion of the existing control programs, further evaluations, such as nitrifier and dispersion studies, may need to be undertaken.

FACTORS NEEDING CLARIFICATION WITH RESPECT TO CAUSE/EFFECT RELATIONSHIPS:

To be determined after the existing control programs have been studied.

KNOWN RELATIONSHIPS TO OTHER ENVIRONMENTAL PROBLEMS:
Currently being evaluated.

WATER QUALITY STATUS:

The following table presents water quality data for Segment 1014 from October 1, 1983 through September 30, 1987. Total dissolved solids were estimated by multiplying specific conductance by a factor of 0.5.

Parameter	Criterion	Number of Samples	Minimum	Maximum	Mean	Number of Values Outside Criteria	Mean Values Outside Criteria
Dissolved Oxygen (mg/L)	3.0	113	2.2	10.6	5.5	5	2.5
Temperature (F)	92.0	113	48.2	86.5	77.8	0	0
pH	6.5-9.0	68	6.6	7.9	7.5	0	0
Chloride (mg/L)	110	59	5	170	79	7	136
Sulfate (mg/L)	65	65	4	249	28	2	170
TDS (mg/L)	600	111	84	538	355	0	0
Fecal Coliforms (#/100 mL)	2000	38	10	74000	2841	27	12546

PA-SCORE

REFERENCE 21

Enter the next ring distance
GEMS>

Enter program execution mode: B (batch) or I (interactive)
GEMS> i

metalcoatings
LATITUDE 29:43:49 LONGITUDE 95:30:50 1980 POPULATION

KM	0.00-.400	.400-.810	.810-1.60	1.60-3.20	3.20-4.80	4.80-6.40	SECTOR TOTALS
S 1	0	0	0	6873	4737	10719	22329
S 2	0	2514	0	15330	11891	12886	42621
S 3	0	0	1591	8890	24211	17089	51781
S 4	0	0	1180	8757	13168	25516	48621
S 5	0	385	2866	10371	9934	8590	32146
S 6	1171	0	2363	6586	11851	17640	39611
RING TOTALS	1171	2899	8000	56807	75792	92440	237109

press RETURN to continue
Esc for ATtention, Home to SWitch ¤ Capture Off ¤ On: 00:08:13

Accessed by Kevin Sayres 2/10/92 4:05pm

PA-SCORE

REFERENCE 22

RECORD OF COMMUNICATION

TYPE:	Outgoing Phone Call	**DATE:**	5-8-92	**TIME:**	3:05 p.m.

TO: Ms. Cantu
Secretary
Piney Point Elementary
Houston, TX
713-782-0130

FROM: Kevin Jaynes
Site Manager
ICF Technology Incorporated
214-979-3900

SUBJECT: Enrollment at Piney Point Elementary

SUMMARY OF COMMUNICATION:

There are 654 students enrolled at Piney Point Elementary.

PA-SCORE

REFERENCE 23

RECORD OF COMMUNICATION

TYPE: Outgoing Phone Call **DATE:** 5-8-92 **TIME:** 2:10 p.m.

TO:
Judy Harris
Secretary of the Principal
Robert E. Lee High School
6529 Beverly Hill
Houston, TX
713-782-7310

FROM:
Kevin Jaynes
Site Manager
ICF Technology Incorporated
214-979-3900

SUBJECT: Enrollment at Lee High School

SUMMARY OF COMMUNICATION:

Ms. Harris stated that current enrollment is approximately 2,500 students.

PA-SCORE

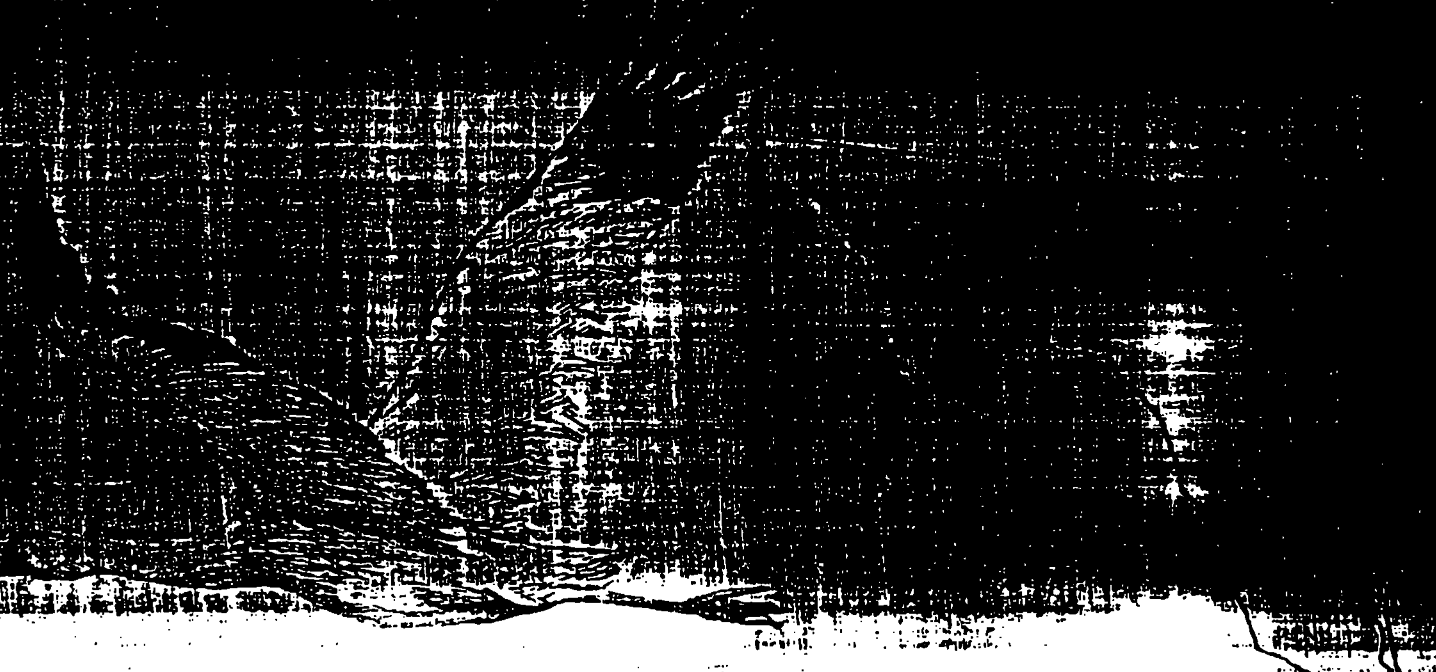
REFERENCE 24

Endangered and

ecies

nd Okla

198



PREFACE

The Endangered Species Act was passed in 1973 to check the precipitous decline of native fish, wildlife, and plants in the United States. The U.S. Fish and Wildlife Service is charged with determining which species face extinction through man's alteration of their habitat, protecting them from further decline and providing for their continued survival. All Federal agencies are charged with using their authorities to carry out programs for the conservation of endangered species and threatened species and must ensure that any action authorized, funded, or carried out by them does not jeopardize the continued existence of any endangered or threatened species or result in the adverse modification of critical habitat of such species.

This summary of Federally listed endangered and threatened species in Texas and Oklahoma has been compiled by the Albuquerque Regional Office of the U.S. Fish and Wildlife Service. The information provided is for general knowledge only; specific data can be obtained from:

U.S. Fish and Wildlife Service
Office of Endangered Species
P.O. Box 1306
Albuquerque, New Mexico 87103
(505) 766-3972

Ecological Services Field Office
U.S. Fish & Wildlife Service
222 S. Houston, Suite A
Tulsa, Oklahoma 74127
(918) 581-7458

Ecological Services Field Office
U.S. Fish & Wildlife Service
819 Taylor Street, Rm. 9A33
Fort Worth, Texas 76102
(817) 334-2961

Ecological Services Field Office
U.S. Fish & Wildlife Service
c/o Corpus Christi State University
Campus Box 338, 6300 Ocean Drive
Corpus Christi, Texas 78412
(512) 888-3346

Ecological Services Field Office
U.S. Fish & Wildlife Service
17629 E. Camino Real, Suite 211
~~Houston~~, Texas 77058 ~~Clear Lake~~
~~(713) 229-3682~~
713 750-1700 Julie Massey

Only plants and animals that are Federally listed as endangered or threatened species have been included in this summary. In addition to these Federally listed species, Texas Parks and Wildlife Department has a list of rare species which have legal protection within State boundaries, and Oklahoma has a list of rare species. Information regarding State-listed species may be obtained from:

Texas Parks and Wildlife Department
4200 Smith School Road
Austin, Texas 78744
(512) ~~479-4800~~
389-4800

Oklahoma Department of Wildlife Conservation
1801 N. Lincoln, P.O. Box 53465
Oklahoma City, Oklahoma 73152
(405) 521-3851

TEXAS BITTERWEED.....*Hymenoxys texana*

STATUS: Endangered (51 FR 8681; 3/13/86) without critical habitat

SPECIES DESCRIPTION: This member of the sunflower family (Asteraceae) is a small, single-stemmed or branching annual reaching a height of up to 4 inches. The small heads (clusters of flowers) are 0.15-0.23 inch long with small yellowish disk flowers. Flowering occurs in late March to early April.

HABITAT: This species occurs in the northern part of the Gulf Coastal Prairie, where it is found in poorly drained saline swales (depressions) around the periphery of low natural mounds (mima mounds) in open grasslands. These mostly barren areas are sparsely vegetated and the soil is covered with a blue-green alga (*Nostoc* sp.).

DISTRIBUTION:

Historic: Harris County, Texas.

Present: The known populations occur in northern and western Harris County, and northern Fort Bend County.

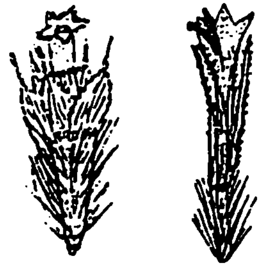
REASONS FOR STATUS: Destruction of habitat due to residential development.

OTHER INFORMATION: Work on propagation and establishment of a botanical garden population is being being done by Mercer Arboretum, Humble, Texas. The recovery plan is being drafted. Protected by the State of Texas.

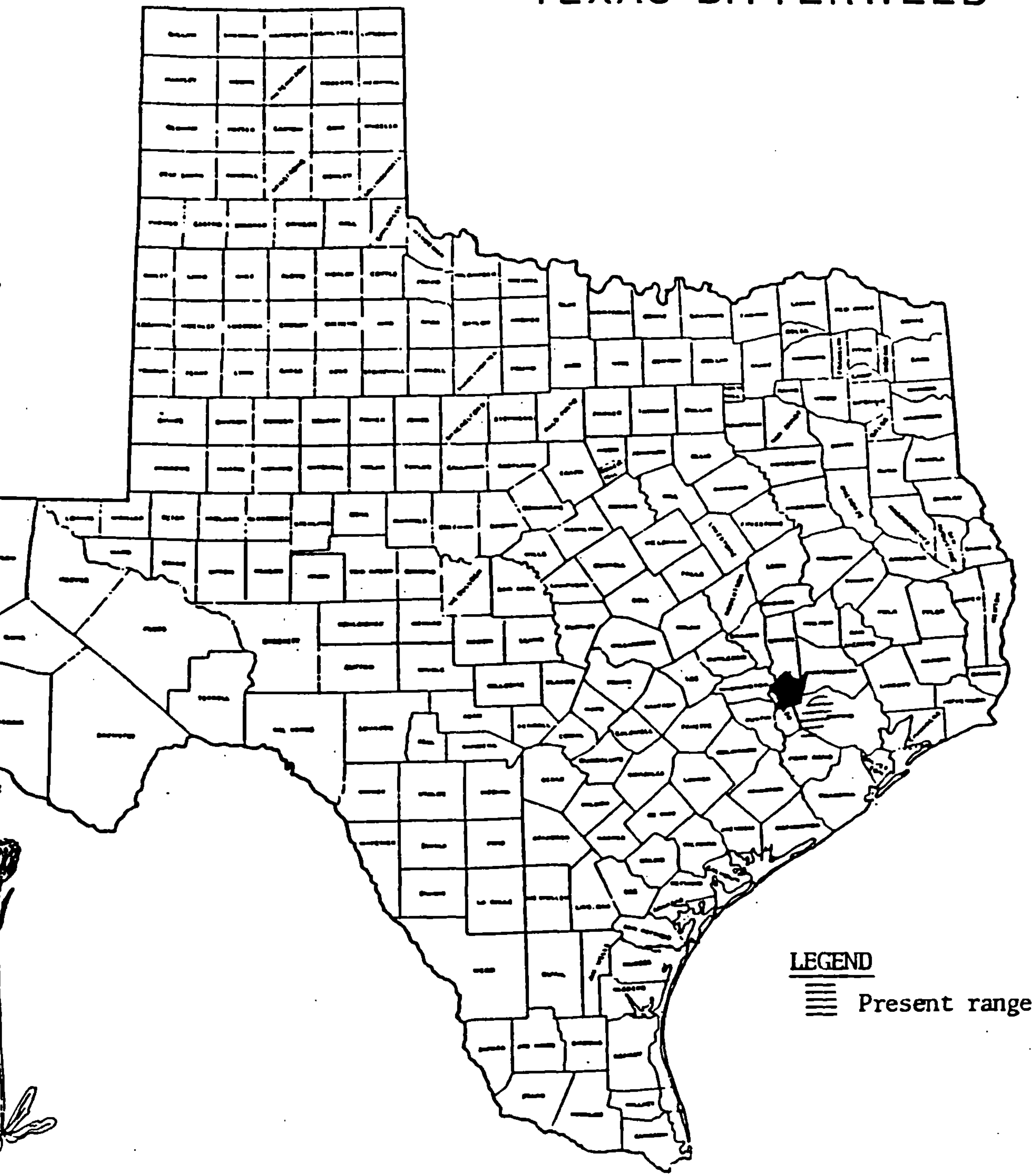
REFERENCES: Correll and Johnston 1970, Mahler 1982b.

TEXAS BITTERWEED

flower head



flowers



PA-SCORE

REFERENCE 25

RECORD OF COMMUNICATION

TYPE: Phone Call **DATE:** 11/30/89 **TIME:** 2:20 p.m.

TO: Kay Hodges
Chamber of Commerce
Houston, TX
(713)-651-1313

FROM: Luis Vega
FIT Biologist
ICF Technology, Inc.
Dallas, TX
(214)-744-1641

SUBJECT:

Population Density of the Houston/Harris County, TX Area

SUMMARY OF COMMUNICATION:

In a phone call with Kay Hodges of the Houston Chamber of Commerce, the following information was given:

> The population of Houston, Harris County, TX in the consolidated metropolitan statistical area is 3,580,000. This includes the surrounding counties and incorporated limits covering an area of 7,422.38 square miles.
>
> The population of Harris County only is 2,740,900.
>
> The population of Houston, Harris County, TX in the principle metropolitan statistical area is 3,182,900, and covers an area of 5,435.48 square miles. The number of households in Houston is 1,196,700, which gives an average population per household of 2.66.

NOTE: The above information is based on the 1980 Census information.

CONCLUSIONS:

Using the data for the principle metropolitan statistical area, the population density for the Houston, Harris County, TX area is calculated as 586 persons per square mile.

> 3,182,900 divided by 5,435.48 square miles = 585.85 persons/square mile (586 persons).